United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Albuquerque District
Socorro Field Office
901 S Hwy 85 Socorro
Socorro, New Mexico 87801

EA DECISION RECORD

PROJECT TITLE: Bordo Atravesado Environmental Assessment

EA NUMBER: DOI-BLM-NM-A020-2022-0014-EA

BACKGROUND

The BLM Socorro Field Office (SFO) proposes to gather and remove excess wild horses from the Bordo Atravesado Herd Management Area (HMA). The SFO has determined that excess wild horses are present on public lands within and outside the boundaries of the HMA. The removal of these wild horses, to within appropriate management level (AML), is necessary to achieve and maintain a thriving natural ecological balance. The Appropriate Management Level (AML) for the HMA is 40-60. The current population estimate from a recent 2022 population inventory is 230 wild horses, which is 4.3 times over the upper limit of AML.

The SFO has prepared an Environmental Assessment (EA) (DOI-BLM-NM-A020-2022-0014-EA) which analyzes the potential environmental impacts of three alternatives: 1) No-Action Alternative; 2) Alternative A (Proposed Action) and; 3) Alternative B (No Fertility Control).

AUTHORITIES

This decision is is in compliance with applicable laws, regulations and policy, including the Federal Land and Policy Management Act, the Endangered Species Act, the Migratory Bird Treaty Act, and the National Historic Preservation Act. It has been reviewed for, and is in conformance with, the Resource Management Plan for the Public Lands Administered by the Bureau of Land Management, Socorro Field Office, September 2010 (Socorro Resource Management Plan).

PUBLIC INVOLVEMENT AND CONSULTATION

A preliminary environmental assessment was made available to interested individuals, agencies and groups for a 30-day public review and comment period that opened on July 27, 2022. The comment period closed on August 27, 2022. Comments were received from approximately 23 individuals or organizations. Many of these comments contained overlapping issues and concerns for a total of 170 comments. A detailed summary of the comments and BLM responses, some of which were used in the final EA, can be found in Appendix G.

The final Environmental Assessment and Finding of No Significant Impact (FONSI) along with this decision can be found on the BLM National NEPA Register ePlanning web page at: https://eplanning.blm.gov/eplanning-ui/project/2020697/570 or by contacting the Socorro Field Office.

DECISION

It is the decision of the Socorro Field Office (SFO) to implement Alternative A (Proposed Action) as described in the Final Bordo Atravesado Environmental Assessment (DOI-BLM-NM-A020-2022-0014-EA). This decision is effective immediately pursuant to 43 CFR 4770.3(c).

Under Alternative A (Proposed Action), the SFO would gather and remove approximately 190 of the existing excess wild horses from within and outside the HMA to achieve and maintain AML, administer population control measures to released mares using continuous bait trapping within a 10-year period. This would allow BLM to achieve management goals and objectives of attaining a herd size that is at the low range of AML to reduce wild horse population growth rates, and maintain a thriving natural ecological balance on the range as required under the WFRHBA.

Upon analyzing the impacts of Alternative A (Proposed Action) and following issuance of the EA for public review; I have determined that implementing Alternative A (Proposed Action) will not have a significant impact to the human environment and that an environmental impact statement is not required as set forth in the attached Finding of No Significant Impact.

The gather is necessary to remove excess wild horses and bring the wild horse population back to within the established AML range in order to achieve a thriving natural ecological balance between wild horses, wildlife, livestock, vegetation and the available water as required under Section 3(b)(2) of the 1971 Wild Free-Roaming Horses and Burros Act and Section 302(b) of the Federal Land Policy and Management Act of I 976.

The BLM is required to manage multiple uses to avoid continued degradation of the rangelands, and removal of excess wild horses is necessary to protect rangeland resources from further deterioration or impacts associated with the current overpopulation of wild horses within the HMA.

Both Alternatives A and B are in conformance with Management Decisions and Legal Mandates (chapter 2) of the approved Resource Management Plan (RMP) for the Public Lands Administered by the Bureau of Land Management, Socorro Field Office (September 2010). The phased gathering of wild horses and application of population control is consistent with the Proposed Action and will occur over a 10- year period following the initial gather operation to achieve management objectives.

Leaving excess wild horses on the range under the No-Action Alternative would not comply with the 1971 WFRHBA or applicable regulations and Bureau policy, nor would it comply with the New Mexico Standards for Public Land Health and Guidelines for Livestock Grazing Management (2001). The No-Action Alternative would allow continued deterioration of rangeland resources, including vegetative and soil as a result of the current overpopulation of wild horses within and outside the HMA, with potentially irreversible loss of native vegetative communities. Wild horses would continue to relocate in increasing numbers to areas outside the HMA due to competition for limited water and forage, adversely impacting public and private land resources not designated for wild horse management. The No-Action Alternative also increases the likelihood of emergency conditions arising, requiring an emergency gather to prevent individual animals from suffering or death due to insufficient forage or water.

Alternative B would allow for AML to be achieved and would be consistent with current land use plans, however, it would also allow for populations to continue to grow at a higher rate. This alternative would require more horses to be removed from the range over the 10-year period.

ADMINISTRATIVE REMEDIES

If you wish to appeal this decision, it may be appealed to the Interior Board of Land Appeals, Office of the Secretary, in accordance with 43 CFR part 4 and Form 1842-1. If you appeal, your appeal must also be filed with the Bureau of Land Management at the following address: Field Office Manager, Mark Matthews, Socorro Field Office, 901 S Hwy 85, Socorro, NM 87801.

Your appeal must be filed within thirty (30) days from receipt or issuance of this decision. You have the burden of showing that the decision appealed from is in error. If you wish to file a petition pursuant to regulation 43 CFR 4.21 (58 FR 4942, January 19, 1993) for a stay (suspension) of the decision during the time that your appeal is being reviewed by the Board, the petition for stay must accompany your notice of appeal. Copies of the notice of appeal and petition for a stay must also be submitted to:

Board of Land Appeals Dockets Attorney
801 N. Quincy Street, Suite 300
Arlington, VA 22203

A copy must also be sent to the appropriate office of the Solicitor at the same time the original documents are filed with the above office.

Regional Solicitor, Southwest Region
505 Marquette Ave.
Albuquerque, NM 87102

A petition for a stay of decision pending appeal shall show sufficient justification based on the following standards:

1. The relative harm to the parties if the stay is granted or denied.
2. The likelihood of the appellant's success of the merits.
3. The likelihood of immediate and irreparable harm if the stay is not granted.
4. Whether the public interest favors granting the stay.

For any document that a party must serve, the party or its representative must sign a written statement certifying that service has been or will be made in accordance with the applicable rules and specifying the date and manner of such service (43 CFR 4.401 (c) (2)).

SIGNATURE OF AUTHORIZED OFFICIAL

MARK MATTHEWS

Digitally signed by MARK MATTHEWS
Date: 2022.10.26 17:47:07 -06'00'

Mark Matthews
Socorro Field Office Manager

Date

Enclosures (2)
Environmental Assessment
FONSI

Finding of No Significant Impact (FONSI)
Bordo Atravesado Wild Horse Gather Plan
DOI-BLM-NM-A020-2022-0014-EA

INTRODUCTION

The Bureau of Land Management (BLM) has completed an environmental review DOI-BLM-NM-A020-2022-0014-EA for the proposed Bordo Atravesado Wild Horse Gather Plan. The Bordo Atravesado Horse Management Area (HMA) is located approximately 15 miles northeast of Socorro, New Mexico in Socorro County. The proposed action, as described in the attached Environmental Assessment, would allow for an initial gather, and follow-up gathers, to be conducted over 10 years from date of the initial gather operation in order to achieve and maintain Appropriate Management Levels (AMLs) along with continued fertility control management. No helicopter operations are proposed in this plan.

FINDING OF NO SIGNIFICANT IMPACT

Based upon a review of the EA and the supporting documents, I have determined that the implementation of any alternative analyzed in DOI-BLM-NM-A020-2022-0014 EA will not have a significant effect on the quality of the human environment. There are no proposed federally controlled connected actions (40 CFR 1501.9(e)(1)). The environmental effects are not significant (40 CFR 1501.3(b)) and do not exceed those effects as described in the Resource Management Plan for the Public Lands Administered by the Bureau of Land Management, Socorro Field Office, September 2010, Socorro Resource Management Plan. Therefore, an environmental impact statement is not required.

Alternatives A and B are consistent with the New Mexico Standards for Public Land Health and Guidelines for Livestock Grazing Management (2001) to maintain a thriving natural ecological balance and multiple use relationship consistent with other resource needs as required under the Wild Free-Roaming Horse and Burros Act of 1971 (WFRHBA).

This finding is based on the potentially affected environment and degree of the effects of the action project as disclosed in the EA and summarized below.

Affected Area

The CEQ regulations at 40 CFR 1501.3(b)(1) state “In considering the potentially affected environment, agencies should consider, as appropriate to the specific action, the affected area and its resources, such as listed and designated critical habitat under the Endangered Species Act.”

The Bordo Atravesado HMA is located within the Pecos-Canadian Plains and Valleys Major Land Resource Area (MLRA) and the Southern Desertic Basins, Plains and Mountains MLRA. The HMA is mountainous with rolling limestone hills. There are 19,606 acres in the wild horse HMA consisting of 16,493 acres of public land (84 percent), 548 acres of private land (3 percent), and 2,565 acres of State land (13 percent) of public and private land. Prominent features on the HMA include the Canon Quemado drainage, running in a north-south orientation through the western portion of the allotment, and the Bordo Atravesado. The HMA is overlapped by portions of the Stallion Special Management Area and the Stallion Wilderness Study Area. The entire HMA is located within the Bordo Atravesado livestock grazing allotment, #01254. Wildlife species known to occur in the HMA are elk, mule deer, pronghorn, coyotes, and various reptiles, rodents, raptors, and songbirds. No Threatened, Endangered or Proposed Threatened, Endangered species are known to be present in the HMA.

Degree of the Effects of the Action

The following is a summary of the degree of the effects (40 CFR 1501.3(b)(2)) for this proposed action.

1. Short- term, long-term effects.

Wild Horse Genetic Diversity and Fertility Control: EA Page 13: The No-Action Alternative would likely result in the wild horse population increasing at the national average rate 20 to 25% per year. Wild horse population levels would not achieve AML or a thriving natural ecological balance, and excess concentrations of wild horses would continue to damage to rangeland resources throughout the HMA. As populations increase beyond the capacity of the habitat, Bands of horses would leave the boundaries of the HMA in search of forage and water. Alternative A (Proposed Action) and Alternative B would decrease the existing overpopulation of wild horses during successive bait and water trapping operations over a period of 10 years. Removal of excess wild horses, coupled with anticipated reduced reproduction as a result of fertility control, would result in improved health and condition of mares and foals. Short-term effects associated with the gathering of the animals may include modified behaviors ranging from nervous agitation to physical distress. In the future, application of population growth suppression techniques (i.e. PZP, PZP-22, GonaCon) and adjustment in sex ratios would be expected to slow total population growth rates, and to result in fewer gathers with less frequent disturbance to individual wild horses and the herd's social structure. However, return of wild horses back into the HMA could lead to decreased ability to effectively gather horses in the future as released horses learn to evade gather operations. No short-term, long-term, beneficial or adverse effects have been determined to be significant.

Wilderness Study Area: EA Page 19: The No-Action Alternative is not anticipated to have direct impacts to wilderness values however, the impacts to wilderness values of naturalness could be threatened through the continued population growth of wild horses. Impacts such as excessive erosion due to increased horse traffic and reduced soil stabilizing vegetative cover would decrease the naturalness of the WSA and therefore impair its suitability for designation as wilderness. The deteriorated habitat would negatively impact opportunities for primitive and unconfined recreation. Under Alternatives A and B, no surface impacts within the Wilderness Study Area (WSA) are anticipated to occur during the gather since all gather sites and holding

facilities are currently existing. However, wilderness values of naturalness would remain at or near the current condition. Wilderness values of naturalness after the gather would be enhanced by a reduction in wild horse numbers as a result of an improved ecological condition of the plant communities and other natural resources. No short-term, long-term, beneficial or adverse effects have been determined to be significant.

Livestock Grazing: EA Page 20: Although livestock would not be displaced or disturbed as a result of gather operations under the No-Action Alternative, there would be continued competition with excess numbers of wild horses for limited water and forage resources. As wild horse numbers continue to increase. Livestock would be reduced in the HMA and, over time, in adjacent areas surrounding the HMA. As competition for forage and water increases, it would become less economically feasible to utilize the areas for domestic livestock resulting in the reduction or elimination of authorized livestock grazing. Under Alternatives A and B, competition between livestock and wild horses for water and forage resources would be reduced over time. Forage availability and quality would improve over time as the wild horse population is incrementally brought to low or mid AML. These effects would be extended by population growth control measures. There would be no long-term effect on domestic livestock. Reaching the AML and maintaining the horse population at this level would allow for an adequate forage supply in both quantity and quality for livestock. No adverse impacts to domestic livestock are anticipated.

Soils, Watershed, and Hydrology: EA Page 21: Under the No-Action Alternative, soils and watersheds would continue to have horse use and as horse populations increase heavy trailing and trampling around water sources and to foraging areas would occur. Declining conditions from compaction, erosion, and consequent poor vegetation support would continue to increase as horse populations increase over time. Under Alternatives A and B, potential for soil compaction (associated with gather operations) would occur but would be minimal and temporary and is not expected to adversely impact soil or hydrologic function. Soils and watersheds would remain at or near the current condition. However, soils and watersheds would likely see improvement over time since wild horse population would be gathered incrementally and growth rates would be less under this alternative. This would result in restored soil structure, increased stability, and improved biological function of soils resulting in increased water-holding capacity, reduced erosion and enhanced vegetation community support.

Wildlife: EA Page 23: Under the No-Action Alternative, increased use over the HMA would adversely impact soils and vegetation health. As native plant health deteriorates and plants are lost, soil erosion increases. Range conditions in and around the HMA would deteriorate significantly. These impacts would be cumulative over time. There would be increased impacts to areas outside the HMA as horses move out in search of better forage. These impacts would have a negative effect on wildlife cover, forage, and movements within the area. Under Alternatives A and B, both negative and positive impacts to wildlife species can occur as horse and cattle grazing impacts vegetative cover. The removal of horses from the area would avoid potential over-utilization of forage and reduction in vegetative ground cover.

Vegetation: EA Page 25: Under the No-Action Alternative, wild horse populations would increase subsequently, the impacts to vegetation by grazing or trampling would increase

resulting in deterioration of plant health, reproduction, diversity, and composition. Over time forage resources would become less available, impacting wild horse herd health, and wild horses would be more susceptible to disease and drought. Under Alternatives A and B, there would be a short-term effect on vegetative resources including trampling of vegetation by wild horses at gather sites and holding locations; and crushing of vegetation by vehicles, temporary corrals and holding facilities. These impacts are temporary, and vegetation is expected to recover within the next growing season. Overtime, reduced concentrations of wild horses would contribute to the recovery of vegetative resource. Additionally, achieving and maintaining the established AMLs throughout the HMA would be expected to result in upward trends in vegetation health, increased vigor, production and frequency of key forage species, and attainment of Rangeland Health Standards.

2. Both beneficial and adverse effects.

In consideration of the beneficial and adverse effects as disclosed in the EA, none are found to exceed those described in the Resource Management Plan for the Public Lands Administered by the Bureau of Land Management, Socorro Field Office, September 2010, Socorro Resource Management Plan or have a significant adverse effect that would trigger an environmental impact statement. The plan has adopted proven monitoring and mitigation measures to reduce impacts associated with gathering, handling, and transporting wild horses and collecting herd data. Data for climate (weather), forage utilization, population inventory, and population distribution would continue to be collected and evaluated.

3. Effects on public health and safety.

All Alternatives would have minimal effects on public health and safety. The Standard Gather Operating Procedures (EA, Appendix D) would be used with Alternatives A and B to conduct the gather and are designed to protect human health and safety, as well as the health and safety of the wild horses.

4. Effects that would violate Federal, State, Tribal, or local law protecting the environment. Degree to which the possible effects on the quality of the human environment are likely to be highly controversial.

No Federal, State, local or tribal laws or requirements imposed for the protection of the environment would be violated as a result of implementing any Alternative. All Alternatives are in conformance with the terms and the conditions of the approved Resource Management Plan for the Public Lands Administered by the Bureau of Land Management, Socorro Field Office, September 2010, Socorro Resource Management Plan.

The Action Alternatives are in conformance with the Wild Free-Roaming Horses and Burros Act of 1971 (as amended), applicable regulations at 43 CFR § 4700, and BLM polices (EA Page 2-3).

SIGNATURE OF AUTHORIZED OFFICIAL

MARK MATTHEWS

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Date: 2022.10.26 17:47:50 -06'00'

Mark Matthews
Socorro Field Office Manager

Date

Enclosure(s):

Bordo Atravesado Environmental Assessment DOI-BLM-NM-A020-2022-0014-EA

United States Department of the Interior
Bureau of Land Management

Bordo Atravesado Environmental Assessment
DOI-BLM-NM-A020-2022-0014-EA

Bordo Atravesado HMA
Wild Horse Gather Plan

U.S. Department of the Interior
Bureau of Land Management
Socorro Field Office
901 S Hwy 85
Socorro, NM 87801

Table of Contents

INTRODUCTION

This Environmental Assessment (EA) has been prepared to analyze the Bureau of Land Management's (BLM) Socorro Field Office (SFO) proposal to gather and remove excess wild horses from within and outside the Bordo Atravesado Herd Management Area (HMA).

The wild horse gather plan would allow for an initial gather and follow-up gathers to be conducted over 10 years from date of the initial gather operation in order to achieve and maintain Appropriate Management Levels (AMLs) and continue fertility control management. This EA will assist the (BLM) Socorro Field Office in project planning and ensuring compliance with the National Environmental Policy Act (NEPA), and in making a determination as to whether any significant effects could result from the analyzed actions. Following the requirements of NEPA (40 CFR 1508.9 (a)), this EA describes the potential impacts of a No-Action, Alternative A (Proposed Action) and Alternative B for the Bordo Atravesado HMA gather. If the BLM determines that the Proposed Action is not expected to have significant impacts a Finding of No Significant Impact (FONSI) would be issued, and a Decision Record would be prepared. If Significant effects are anticipated, the BLM would prepare an Environmental Impact Statement.

Background

Since the passage of the *Wild Free-Roaming Horses and Burros Act of 1971(*WFRHBA*)*, management knowledge regarding wild horse population levels has increased. For example, it has been determined that wild horses are capable of increasing their numbers by 15% to 25% annually, resulting in the doubling of wild horse populations about every 4 years (NRC 2013). This has resulted in the BLM shifting program emphasis beyond just establishing AML and conducting wild horse gathers to include a variety of management actions that further facilitate the achievement and maintenance of viable and stable wild horse populations and a "thriving natural ecological balance" (TNEB). Management actions resulting from a shifting program emphasis include increasing fertility control, adjusting sex ratio and collecting genetic baseline data to support genetic health assessments.

The AML is defined as the number of adult wild horses that can be sustained within a designated HMA which achieves and maintains a thriving natural ecological balance (TNEB) in keeping with the multiple-use management concept for the areas. In the past two decades, WHB program goals have also explicitly included conducting gathers, applying contraceptive treatments to reduce total population growth rates and increase the time between gathers necessary to remove excess animals, so as to manage for healthy wild horse and wild burro populations, and healthy rangelands by achieving and maintaining populations within the established AML. The use of fertility control methods 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 conducting accurate population inventories and collecting genetic diversity monitoring data to support population-level genetic health assessments.

The Bordo Atravesado HMA is located about 15 miles northeast of Socorro, New Mexico in Socorro County. The Bordo Atravesado HMA falls within the Bordo Atravesado Grazing Allotment (Map Appendix A).

The current estimated population within and outside the Bordo Atravesado HMA for 2022 is 230 wild horses as of March 19, 2022. This estimate is based on an aerial survey using the simultaneous double-observer method. Current population estimates reflect the assumption that wild horse herds in this area increase 20-25% or more per year, which is consistent with the published rates (NAS 2013, Ransom et al. 2016). The current population is 4.3 times above the upper limit of AML.

Based upon all information available at this time, including the 2022 survey the BLM has estimated approximately 190 wild horses above the low end of AML exist within and outside the Bordo Atravesado

HMA. These excess wild horses need to be removed, in order to achieve the lower end of the established AML, restore thriving natural ecological balance and prevent further degradation of rangeland resources from the current overpopulation of wild horses.

Purpose and Need for Action and Decision to be Made
The purpose of the Proposed Action is to gather and remove excess wild horses from within and outside the Bordo Atravesado HMA and to reduce the wild horse population growth rates to achieve and maintain established AML ranges.

The need for the action is to prevent undue or unnecessary degradation of the public lands associated with excess wild horses, and to preserve and maintain a thriving natural ecological balance and multiple-use relationship on public lands, consistent with the provisions of Section 1333(b) of the 1971 Wild Free-Roaming Horses and Burros Act (WFRHBA). The decision to be made is whether or not to remove excess horses and introduce fertility control practices into the population.

Land Use Plan Conformance and Consistency with Other Authorities
The Proposed Action is in conformance with the terms and the conditions of the approved Resource Management Plan for the Public Lands Administered by the Bureau of Land Management, Socorro Field Office, September 2010, Socorro Resource Management Plan.

The Action Alternatives are in conformance with the Wild Free-Roaming Horses and Burros Act of 1971 (as amended), applicable regulations at 43 CFR § 4700, and BLM polices.

> **43 CFR § 4710.4 Constraints on Management:** Management of wild horses shall be undertaken with the objective of 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 shall remove the excess animals immediately.

Relationship to Laws, Regulations, and Other Plans
The Federal Land Policy and Management Act of 1976 (FLPMA) requires that an action under consideration be in conformance with the applicable BLM land use plan(s), and be consistent with other federal, state, and local laws and policies to maximum extent possible.

Alternative A (Proposed Action) is also consistent with the Wild Free-Roaming Horses and Burros Act of 1971 (WFRHBA), which mandates the Bureau to "prevent the range from deterioration associated with overpopulation", and "remove excess horses in order to preserve and maintain a thriving natural ecological balance and multiple use relationships in that area".

Also the WFRHBA of 1971 Sec 1333 (b)(1) states: "The purpose of such inventory shall be to: make determinations as to whether and where an overpopulation exists and whether action should be taken to remove excess animals; determine appropriate management levels or wild free-roaming horses and burros on these areas of public land; and determine whether appropriate managements should be achieved by the removal or destruction of excess animals, or other options (such as sterilization, or natural control on population levels)."

Alternative A (Proposed Action) is consistent with all applicable at laws and regulations at Title 43 Code of Federal Regulations (43 CFR) 4700, (43 CFR) 4710.01 and policies.

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

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

43 CFR 4720.1 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 4720.2 Upon written request from a private landowner……the Authorized Officer shall remove stray wild horses and burros from private lands as soon as practicable.

The Interior Board of Land Appeals (IBLA) in Animal Protection Institute et. Al., (118 IBLA 63, 75 (1991)) found that under the Wild Free-Roaming Horses and Burros Act of 1971 (Public Law 92-195) BLM is not required to wait until the range has sustained resource damage to reduce the size of the herd, instead proper range management dictates removal of "excess animals" before range conditions deteriorate in order to preserve and maintain a thriving natural ecological balance and multiple-use relationship in that area.

DESCRIPTION OF ALTERNATIVES AND PURPOSED ACTIONS

Introduction
This section of the EA describes Alternative A (Proposed Action) and Alternatives, including any that were considered but eliminated from detailed analysis. Alternatives analyzed in detail including the following:

> **No-Action Alternative:** Under the No Action Alternative, a gather to remove excess wild horses would not occur. There would be no active management to control population growth rates, the size of the wild horse population or to bring the wild horse population to AML.
>
> **Alternative A (Proposed Action):** Over a 10 year period, use phased gathers to remove excess animals in order to achieve and maintain the population within low AML range, apply fertility control methods (vaccines) to mares released back into HMA.
>
> **Alternative B:** Alternative B is the same as Alternative A, except it would not include fertility control and would establish a sex ratio 60% male and 40% females.

No-Action Alternative:

Under the No-Action Alternative, a gather to remove excess wild horses would not occur. There would be no active management to control the size of the wild horse population or to bring the wild horse population to AML. The current wild horse population would continue to increase at a rate of 20-25% per year. Within two years, the wild horse population could exceed 341 horses. Wild horses residing outside the HMA would remain in areas not designated for management of wild horses and population numbers would continue to increase. The increasing numbers of excess wild horses will continue to deteriorate rangelands within and outside the HMA, public safety concerns will increase along heavily traveled road as well as private property issues, and an increase in emergency actions will be necessary to address the overpopulation of wild horses and limited water/forage resources.

Alternative A: Proposed Action

Population Management
Alternative A (Proposed Action) would be to gather and remove excess wild horses within and outside the HMA to achieve and maintain AML and administer or booster population control measures to gathered and released horses over a period of ten years from the initial gather. This would allow BLM to achieve management goals and objectives of attaining a herd size that is at the low range of AML, reducing population growth rates, and achieving a thriving natural ecological balance on the range as identified within the WFRHBA.

The management objective for the Bordo Atravesado would be to gather remove excess wild horses within and outside the herd management area to achieve and maintain AML. BLM would achieve this through population growth suppression measures to include:

- Administration of fertility control measures (i.e. Porcine Zona Pellucida (PZP) vaccines, GonaCon- Equine or newly developed vaccine formulations) to mares released back into HMA.

The fertility control component of Alternative A (Proposed Action) would reduce the total number of wild horses that would otherwise be permanently removed from the range. Including some fertility control-treated mares, while still reducing population growth rates compared to those of an untreated herd and achieving a thriving natural ecological balance. Primary gather methods would be low stress bait, and water trapping within an established and previously used facility (corral).

While in the temporary holding corral, horses would be identified for removal or release based on age, gender and/or other characteristics. As a part of periodic sampling to monitor wild horses' genetic diversity in the HMA, hair follicle samples would be collected from a minimum of 25 horses in the released population. Samples would be collected for analysis to assess the levels of observed heterozygosity, which is a measure of genetic diversity (BLM 2010), within the herd and may be analyzed to determine relatedness to established breeds and other wild horse herds. Mares identified for release would be aged, microchipped and freeze marked for identification prior to being released to help identify the animals for future treatments/boosters and assess the efficacy of fertility control treatments.

Population Growth Suppression Methods
Alternative A (Proposed Action) would include population growth suppression methods such as fertility control vaccines in the herd. In cases where booster vaccine is required, mares could be held for approximately 30 days and given a booster shot prior to release. Through multiple gathers over the 10-year time period, BLM would treat/retreat mares with fertility control to help meet herd management objectives. Since release of the 2013 NRC Report, the BLM has supported field trials of potential sterilization methods that may be used in WHB management, but inclusion of any particular method for population management is not contingent on completion of any given research project. The use of any new fertility control method would conform to current best management practices at the direction of the National Wild Horse and Burro Program.

All mares that are trapped and selected for release would be treated with fertility control treatments (PZP vaccines [ZonaStat-H, PZP-22], GonaCon or most current formulation) to prevent pregnancy in the following year(s).

Porcine Zona Pellucida (PZP) Vaccine
Immunocontraceptive Porcine Zona Pellucida (PZP) vaccines are 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 vaccine was one of the preferred available methods for contraception in wild horses and burros (NRC 2013). PZP vaccine 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 vaccine can be 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, Carey et al. 2019). It can easily be remotely administered (dart-delivered) in the field, but only where mares are relatively approachable.

Under Alternative A (Proposed Action), mares being treated for the first time would receive a liquid primer dose along with time release pellets. 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. Application methods could be by hand in a working chute during gathers, or through field darting if mares in some portions of the HMA prove to be approachable. 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, and not all mares would be treated or receive boosters within the HMA. Once the population is at AML and population growth seems to be stabilized, BLM could use population planning software (PopEquus, currently in development by USGS Fort Collins Science Center) to determine the requiredfrequency of re-treating mares with PZP or other fertility control methods.

Gonadotropin Releasing Hormone (GnRH) Vaccine, GonaCon 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 (Baker et al. 2018) and on a small number of wild horses in the Water Canyon area within the Antelope Complex (DOI-BLM-NV-L020-2015-0014-EA). Gona-Con-Equine is currently being administered in Oregon, Idaho and Utah as well innumerous HMAs. 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 meters or less (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 United States Department Agriculture-Animal and Plant Health Inspection Service laboratory. Its categorization as a pesticide is consistent with regulatory framework for controlling overpopulated vertebrate animals, and inno 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- Equine was deemed to pose low risks to the environment, so long as the product label is followed (Wang-Cahill et al. in press).

Under Alternative A (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. Booster dose effects may lead to increased effectiveness of contraception, whichis generally the intent. GonaCon-Equine can safely be reapplied as necessary to control the population growth rate. Even with one booster treatment of GonaCon-Equine, it is expected that most, if not all, mares would return to fertility at some point, although the average duration of effect after booster doses has not yet been quantified. It is unknown what would be the expected rate for the return to fertility rate inmares boosted more than once with GonaCon-Equine. Once the herd size in the project area is at AML and population growth seems to be stabilized, BLM would make a determination as to the required frequency of new mare treatments and mare re-treatments with GonaCon or other fertility control methods, to maintain the number of horses within AML.

Alternative B

Alternative B is similar to Alternative A except it would not include fertility control and would establish a sex ratio adjustment. Mares captured and released back on HMA would not receive any fertility control. This alternative is not expected to reduce annual horse herd growth rates as much as alternative A.

Sex Ratio Adjustment

Sex ratio adjustment, leading to a reduced fraction of mares in the herd, can be considered a form of contraceptive management, in so far as it can reduce the realized per-capita growth rate in a herd. By reducing the proportion of breeding females in a population (as a fraction of the total number of animals present), the technique leads to fewer foals being born, relative to the total herd size. Sex ratio is typically adjusted in such a way that 60 percent of the horses are male. In the absence of other fertility control treatments, this 60:40 sex ratio alone can temporarily reduce population growth rates from approximately 20% to approximately 15% (Bartholow 2004). While such a decrease in growth rate may not appear to be large or long-lasting, the net result can be that fewer foals are born, at least for a few years – this can extend the time between gathers, and reduce impacts on-range, and costs off-range.

Management Actions Common to Alternatives A and B

Gathering of horses and removal of excess wild horses to achieve and maintain the AML would occur as necessary for the next 10 years following the start date of the initial gather. The primary gather technique would be water/bait trapping to gather horses from within and outside the Herd Management Area. Trapping activities will occur at existing corrals where horses are familiar with the water sources.

The timing of the initial gather is subject to BLM Headquarters Office approval. Several factors such as animal condition, herd health, weather conditions, logistics, or other considerations could result in adjustments in the schedule. Multiple gathers may occur within a ten-year time frame that begins after the initial gather to achieve and maintain wild horse and burro populations within AML.

Gather operations involve areas within the HMA as well as outside the HMA boundaries where excess wild horses are located.

All management activities would be humane, in accordance with the WFRHBA.

Decisions to humanely euthanize animals in field situations would be made in conformance with BLM policy (Permanent Instruction Memorandum 2021-007, attachment 1)

Data including sex and age distribution, condition class information (using the Henneke body condition score (BCS)), color, size and other information may also be recorded, along with the disposition of the animal (removed or released).

Hair follicle samples may be collected from a minimum of 25 animals returned to the HMA to assess the current genetic diversity in the herd, and their relatedness to other, previously sampled herds. Samples would also be collected during future gathers as needed to determine whether BLM's management is maintaining acceptable genetic diversity (i.e., avoiding high risk of inbreeding depression).

In the event that genetic monitoring indicates relatively low levels of observed heterozygosity (a measure of genetic diversity), additional wild horses could be introduced into the Bordo Atravesado HMA to augment genetic diversity in the herd.

A BLM contract Veterinarian, Animal and Plant Health Inspection Service (APHIS) Veterinarian or other licensed Veterinarian would be on call or on site as the gather is started and then as needed for the duration of the gather to examine animals and make recommendations to the BLM for the care and treatment of wild horses and ensure humane treatment. Additionally, animals transported to all BLM off range corrals (ORCs) are inspected by facility staff and the BLM contract Veterinarian, to observe health and ensure the animals have been cared for humanely.

Noxious weed monitoring at gather sites and temporary holding corrals would be conducted during normal HMA monitoring visits.

Monitoring of rangeland forage condition and utilization, water availability, aerial population surveys and animal health would continue.

Bait/Water Trapping

Horses will be bait/water trapped at existing corrals containing man-made sources of water within the HMA. As they approach the water within the corral, a gate will be closed behind them. The capture area will be checked multiple times per day to ensure that the horses have adequate feed and water and will be stressed as little as is practicable. Gathering of the excess wild 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 (vaccines).

All capture and handling activities (including capture site selections) will be conducted in accordance with Standard Operating Procedures (SOPs) described in Appendix B. Selection of capture techniques would be based on several factors such as herd health, season of the year and environmental considerations.

Bait and /or water trapping methods will be used to complete the management actions. In addition to analysis of gathers to address the purpose and need, this EA and decision would address management needs in regard to public safety, emergency situations and private land issues.

Trap sites and temporary holding facilities would be located in previously used sites or other disturbed areas whenever possible. Undisturbed areas identified as potential trap sites or holding facilities would be inventoried for cultural resources. If cultural resources are encountered, these locations would not be used unless they could be modified to avoid impacts.

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), consistent with BLM IM 2021-007 or updated policy.

Transport, Off-range Corrals, and Adoption Preparation
All gathered wild horses would be removed and transported to BLM off-range corrals (ORC, formerly short-term holding facility 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 ORC 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 10 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 contract 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 (ORP). Preparation involves freeze-marking the animals with a unique identification number, vaccination against common diseases, castration, microchipping, and de-worming.

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 WFRHBA (as amended) and congressional limitations.

Off-Range Pastures
When shipping wild horses for adoption, sale, or 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. 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 (as amended), healthy excess wild horses can be euthanized or sold without limitation if there is no adoption demand for the animals. However, while euthanasia of healthy WHB 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 Bordo Atravesado 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 (Permanent Instruction Memorandum (PIM) 2021-007 or most current edition).

Public Viewing Opportunities
Spectators and viewers would be prohibited as it would negatively impact the ability to capture wild horses. Only essential gather operation personnel would be allowed at the trap site during operations.

Alternatives Considered but Eliminated from further Consideration

Remove or Reduce Livestock within the HMA
This alternative would involve no removal of wild horses and would instead address excess wild horse numbers through removal or reduction of livestock within the HMAs. In essence, this alternative would simply exchange use by livestock for use by wild horses. This alternative was not brought forward for analysis because it is inconsistent with the Socorro Field Office RMP, and the WFRHBA which directs the Secretary to immediately remove excess wild horses.

The proposal to reduce livestock would not meet the Purpose and Need for action identified in Section 1.2: “to achieve and maintain the AML through removal of excess wild horses from within and outside of the HMA boundaries, and to reduce the population growth rate prevent undue or unnecessary degradation of the public lands, and protect rangeland resources from deterioration associated with excess wild horses within the HMAs, 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 1971 WFRHBA.”

Eliminating or reducing grazing in order to shift forage use to wild horses would not be in conformance with the existing Land Use Plans and is contrary to the BLM’s multiple-use mission as outlined in FLPMA and would be inconsistent with the WFRHBA and PRIA. It was Congress’ intent to manage wild horses and burros as one of the many uses of the public lands, not a single use. Therefore, the BLM is

required to manage wild horses and burros in a manner designed to achieve a thriving natural ecological balance between wild horse and burro populations, wildlife, domestic livestock, vegetation, and other uses. Information about the Congress' intent is found in the Senate Conference Report (92-242) which accompanies the 1971 WFRHBA (Senate Bill 1116): "*The principal goal of this legislation is to provide for the protection of the animals from man and not the single use management of areas for the benefit of wild free-roaming horses and burros. It is the intent of the committee that the wild free-roaming horses and burros be specifically incorporated as a component of the multiple-use plans governing the use of the public lands.*"

Furthermore, simply re-allocating livestock Animal Unit Months (AUMs) to increase the wild horse AMLs would not achieve a thriving natural ecological balance. Wild horses are unlike livestock which can be confined to specific pastures, limited to specific periods of use, and specific seasons-of-use so as to minimize impacts to vegetation during the critical growing season and during the summer months. Wild horses are present year-round and their impacts to rangeland resources cannot be controlled through establishment of a grazing system, such as for livestock. Thus, impacts from wild horses can only be addressed by limiting their numbers to a level that does not adversely impact rangeland resources and other multiple uses.

Livestock grazing can only be reduced or eliminated through provisions identified within regulations at 43 CFR § 4100 and must be consistent with multiple use allocations set forth in LUP/RMPs. Such changes to livestock grazing cannot be made through a wild horse gather decision and are only possible if BLM first revises the LUPs to allocate livestock forage to wild horses and to eliminate or reduce livestock grazing. Because this alternative is inconsistent with the Socorro Resource Management Plan, it would first require amendments to the RMP, which is outside the scope of this EA.

Gather the HMA to the AML Upper Limit

Under this Alternative, a gather would be conducted to remove enough wild horses to achieve the upper range of the AML. This Alternative was dismissed from detailed study because AML would be exceeded by the next foaling season following gather resulting in the need to conduct another gather within one year. This would result in increased stress to individual wild horses and the herd and resource damage due to wild horse overpopulation in the interim, as the upper level of the AML established for the HMA represents the maximum population for which TNEB would be maintained. This Alternative is not consistent with the WFRHBA, which upon determination excess wild horses and burros are present requires their immediate removal.

Fertility Control Treatment Only (No Removal)

Under this Alternative, no excess wild horses would be removed. Population modeling was completed to analyze the potential impacts associated with conducting gathers about every two to three years over the next 20-year period to treat captured mares with fertility control. Due to the vast size of this HMA, wide distribution of animals, and accessibility to the animals, remote darting opportunities are extremely limited because of the annual retreatment requirements to maintain vaccination efficiency. While the average population growth would be reduced to approximately 13 percent (as modeled in WinEquus) per year, AML would still not be achieved through fertility control alone and damage to the range associated with wild horse overpopulation would continue. Moreover, this Alternative would not meet the Purpose and Need for the Action and would be contrary to the WFRHBA.

AFFECTED ENVRONMENT AND ENVIRONMENTAL EFFECTS

Scoping and Issues:
Internal scoping was conducted by interdisciplinary (ID) team on April 4, 2022, that analyzed the potential consequences of Alternative A (Proposed Action). Potential impacts to the following resources/concerns were evaluated in accordance with criteria listed in the NEPA Handbook H-1790-1 (2008) page 41, to determine if detailed analysis was required. Consideration of some of these items is to ensure compliance with laws, statutes or Executive Orders that impose certain requirements upon all Federal actions. Table 1. summarizes human environment and other resources of concern within the project area are present or not affected by Alternative A (Proposed Action).

Table 1 Summary of Human Environment and Other Resources of Concern

Resource/Concern	**Issue(s) Analyzed? (Y/N)**	**Rationale for Dismissal from Detailed Analysis or Issue(s)Requiring Detailed Analysis**
Air Quality	N	Air quality throughout the project area is good. Dust storm events and other sources are not of a frequency or duration to detract from the overall good air quality of the area.
Native American Religious Concerns	N	Not Present
Cultural Resources	N	Should new, previously undisturbed gather sites or holding facility locations be required, appropriate Class III cultural resource inventories would be conducted to avoid placing gather facilities in areas with cultural resources and to ensure that measures are taken to avoid any cultural resource impacts.
Environmental Justice and Socioeconomics	N	The Proposed Action would not have disproportionately high or adverse effects on low income or minority populations. Health and environmental statues would not be compromised. The proposed Action would not disproportionately impact social or economic values.
Invasive, Nonnative Species	N	No invasive weeds have been found within the HMA. Invasive weed identification and management is done in conjunction with the allotment monitoring and HMA supervision on a continual basis.
Land Tenure, ROW, other Realty Uses, issues, or concerns	N	Two county roads provide reasonable road access to majority of the allotment and HMA, currently limited to existing roads and trails.
Livestock Grazing	Y	Effects to resource are analyzed in this EA
Water Quality, Drinking/Ground	N	The proposed action or alternatives would not affect drinking or groundwater quality.
Recreation	N	Project activities would be temporary and would have no effects on recreation.
Soils	Y	Effects to resource are analyzed in this EA

Vegetation	Y	Impacts under each alternative could result in improving or deteriorating native plant communities. Effects to resource are analyzed in this EA.
Visual Resources	N	The HMA is located within Visual Resource Management (VRM) Classes II and IV. The WSA is considered moderate in regard to scenic quality.
Wild Horses	Y	Effects to resource are analyzed in this EA.
Wildlife	Y	Impacts under each alternative could result in improving or deteriorating wildlife habitat. Effects to resource are analyzed in this EA
Wilderness	Y	Effects to resource are analyzed in this EA.

General Setting
The Bordo Atravesado Herd Management Area is within the Pecos-Canadian Plains and Valleys Major Land Resource Area (MLRA) and the Southern Desertic Basins, Plains and Mountains MLRA. Characterized by generally mountainous with rolling limestone hills. Elevations within the HMA range 5,500 feet (1,676 meters) in the lowlands to a height of 6,970 feet (2,125 m) in the uplands. There are 19,606 acres in the wild horse herd management area consisting of 16,493 acres of public land (84 percent), 548 acres of private land (3 percent), and 2,565 acres of State land (13 percent) of public and private land. Prominent features on the HMA include the Canon Quemado drainage, running in a north-south orientation through the western portion of the allotment, and the Bordo Atravesado.

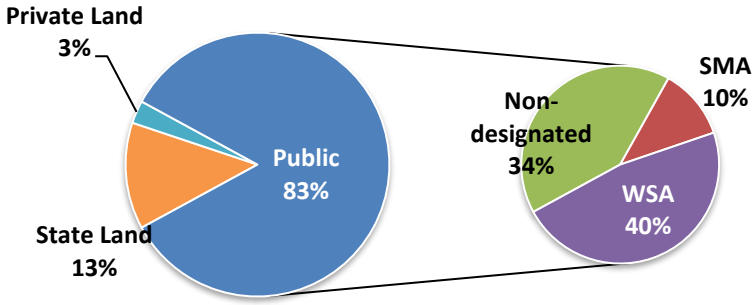
Wild Horses

Affected Environment
The Bordo Atravesado HMA boundary was delineated by the following: wild horse movements and use patterns; horse population and vegetation inventories; allotment terrain, water sources and existing fences (refer to Table 2 for land status acreages and Map 1 for allotment boundary map).

The HMA is entirely contained within the Bordo Atravesado grazing allotment. It is comprised of a mix of public, state, and private lands. Table 1 shows the breakdown of land ownership within the HMA:

Table 2: Land Status Within the Bordo Atravesado Allotment

	HMA Acres	Percent of HMA
State Land	2,565	13.08%
Private Land	548	2.80%
Public: Non-designated	6,772	34.54%
Public: SMA	1,920	9.79%
Public: WSA	7,800	39.79%
TOTALS	**19,605**	**100.00%**



The HMA was last gathered in May 2012. At that time, 94 wild horses were gathered, 54 removed, and 40 horses released back to the HMA.

Wild horses have been observed on the rim of the Tecolote Draw Allotment (#01280), which is just north of the HMA, and within the extreme western portion of the Sierra Larga Allotment (#01260), which borders the HMA to the east. Due to overpopulation and lack of forage within the HMA wild horses have moved outside of the HMA in search of critical habitat, horses have been seen to the southeast on the Coyote Spring Allotment (#01266) utilizing a spring on private land. The permittee had informed the BLM and since verified 18-20 horses outside the HMA.

Monitoring data was collected in May of 2021 using Range Utilization Key Forage Plant Method indicated Heavy (61-80%) utilization and as severe (81-100%). The key forage species for which BLM collected were: Blue grama grass, Black grama grass, galleta grass and Alkaline Sacaton grass.

Genetic Diversity

The AML for wild horses in Bordo Atravesado HMA is relatively small, but the BLM will continue to monitor genetic diversity in the herd and take actions as necessary to ensure that adequate genetic diversity exists in the herd. Even though the herd is geographically isolated from other BLM-managed wild horse herds, history, context, and periodic introductions mean that wild horses that live in the Bordo Atravesado HMA herd are not a truly isolated population. The National Academies of Sciences report to the BLM (2013) recommended that single HMAs should not be considered isolated genetic populations. Rather, managed herds of wild horses should be considered as components of interacting metapopulations, connected by interchange of individuals and genes due to both natural and human-facilitated movements. These animals are part of part of a larger metapopulation (NAS 2013) that has demographic and genetic connections with other wild horse herds throughout the western USA. Herds in the larger metapopulation have a background of shared domestic breed heritage and natural and intentional movements of animals between herds. In this sense, the genetic condition of horses in Bordo Atravesado HMA is similar to that of many other herds managed by the BLM.

The 2013 National Academies of Sciences report included evidence that shows that the Bordo Atravesado hma herd is not genetically unusual, with respect to other wild horse herds. Specifically, Appendix F of the 2013 NAS report is a table showing the estimated 'fixation index' (Fst) values between 183 pairs of samples from wild horse herds. Fst is a measure of genetic differentiation, in this case as estimated by the pattern of microsatellite allelic diversity analyzed by Dr. Cothran's laboratory. Low values of Fst indicate that a given pair of sampled herds has a shared genetic background. The lower the Fst value, the more genetically similar are the two sampled herds. Values of Fst under approximately 0.05 indicate virtually no differentiation. Values of 0.10 indicate very little differentiation. Only if values are above about 0.15 are any two sampled subpopulations considered to have evidence of elevated differentiation (Frankham et al. 2010.). Fst values for the Bordo Atravesado HMA herd had pairwise Fst values that were less than

0.05 with over 120 other sampled herds throughout the western USA. These results support the interpretation that Bordo Atravesado HMA horses are components in a highly connected metapopulation that includes horse herds in many other HMAs.

Based on hair follicle samples taken from wild horses of Bordo Atravesado HMA in 2012, the ancestry of horses in this area is of mixed origin, with no clear indication of primary breed type (Cothran 2013). With reference to observed heterozygosity, Cothran (2013) found levels of genetic diversity that were average to slightly below average with respect to other wild horse herds, and recommended that this herd have the kind of continued genetic monitoring that is included in the action alternatives considered in this EA. The herd's similarity to other BLM-managed herds (based on pairwise Fst values) and maintenance of near-average or slightly below average genetic diversity levels (Cothran 2013) are likely results, to some extent, of historical introductions of fertile horses from other areas in the recent past. Under the action alternatives in this EA, management of the Bordo Atravesado HMA herd can include wild horse introductions from other HMAs to augment genetic diversity. The expected result of introductions would be to reduce the risk of inbreeding-related health effects, and to increase observed heterozygosity. Introducing a small number (i.e., approximately 2-4) fertile animals every generation (about every 8-10 years) is a standard management technique that can alleviate potential inbreeding concerns (BLM 2010), and the action alternatives allow for such introductions if values of observed heterozygosity (a measure of genetic diversity) indicate that is warranted.

Environmental Effects

No-Action Alternative
Under the No-Action Alternative, no population growth suppression action or wild horse removals (gathers) would take place. The population of the wild horses within the Bordo Atravesado HMA would continue to grow at the national average rate of increase seen in the majority of HMAs of 20 to 25% per year. The wild horse population levels would not achieve AML or a thriving natural ecological balance, and excess concentrations of wild horses would continue to impact site specific areas throughout the HMA. The HMA is experiencing heavy to severe utilization by wild horses and would increase over time and degradation could become irreversible in areas where ecological thresholds are passed.

This alternative would be expected to result in increasing damage to rangeland resources throughout the HMA. Trampling and trailing damage by wild horses will continue to impact rangeland resources would also be expected to increase, resulting in larger, more extensive areas of poor range condition, some of which might be unable to recover even after removal of excess horses. Competition for the available water and forage among wild horses, domestic livestock, and native wildlife would continue and further increase.

As populations increase beyond the capacity of the habitat, more bands of horses would also leave boundaries of the HMA in search of forage and water, thereby increasing impacts to rangeland resources outside the HMA boundaries as well. This alternative would result in increasing numbers of wild horses in areas not designated for their use and would not achieve and thriving natural ecological balance.

Alternative A (Proposed Action)
Alternative A (Proposed Action) would decrease the existing overpopulation of wild horses in the course of successive bait and water trapping operations over a period of 10 years. Any mares that would be returned to the range would be treated with fertility control (PZP vaccines, GonaCon). The target population when the objectives of this alternative are reached is to manage a total population at within the AML, or roughly 40-60 wild horses. The areas experiencing heavy and severe utilization levels by wild horses would likely still be subject to some excessive use and impacts to rangeland resources, those being

concentrated trailing, increased bare ground, etc. These impacts would be expected to continue until the project area's population can be reduced to the AML range and concentration of horses can be reduced.

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 large gathers and reduce disturbance to individual animals as well as to the herd social structure over the foreseeable future. Bringing the wild horse population size back to low AML and slowing its growth rate once that level has been achieved 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.

Managing a self-sustaining population would allow BLM to manage the wild horse population at the mid-range of AML once the low AML has been achieved, without adversely impacting rangeland resources as a result of a more rapid population growth in excess of AML.

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 (Scasta 2019). Other impacts to individual wild horses include separation of members of individual bands of wild horses and removal of animals from the population.

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

Fertility Control

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) as viable management approaches. 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 the sections (PZP Direct Effects and GnRH) below, 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 throughout their lifespan, as described above. See Appendix D for a more detailed analysis on fertility control.

Effects Common to Alternative A (Proposed Action) and Alternative B

Water and Bait Trapping
Gathering of the excess wild 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.

Impacts to individual animals would be similar to those for helicopter gathers and could occur as a result of stress associated with the gather, capture, processing, and transportation of animals. The intensity of these impacts would vary by individual and would be indicated by behaviors ranging from nervous agitation to physical distress. Mortality of individual horses from these activities is rare but can occur.

When actively trapping wild horses, the trap would be checked on a daily basis. Wild 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.

Other impacts to individual wild horses include separation of members of individual bands and removal of animals from the population.

Indirect impacts can occur to horses after the initial stress event and could include increased social displacement or increased conflict between studs. These impacts are known to occur intermittently during wild horse gather operations. Traumatic injuries could occur and typically involve bruises caused by biting and/or kicking. Horses may potentially strike or kick gates, panels or the working chute while in corrals or trap which may cause injuries. These impacts, like direct individual impacts, are known to occur intermittently during wild horse gather operations. Since handling, sorting and transportation of horses would be similar to those activities under Helicopter drive trapping, the direct and indirect impacts would be expected to be similar as well. Past gather data shows that euthanasia, injuries and death rates for both types of gathers are similar.

Gathering To Low AML

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

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

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

Mortality at ORCs facilities averages approximately 5% (GAO-09-77, Page 51), which includes animals euthanized due to a pre-existing condition, animals in extremely poor condition, animals that are injured and would not recover, animals that are unable to transition to feed; and animals that die accidentally during sorting, handling, or preparation.

ORPs, known formerly as long-term holding pastures, 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. Mares and sterilized stallions (geldings) are segregated into separate pastures except at one facility where geldings and mares coexist. About 39,000 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, Iowa, Missouri, Montana**,** Nebraska, Utah, Wyoming, Washington, and South Dakota (As of June 2022). The establishment of ORPs is subject to a separate NEPA and decision-making process. Located mainly in mid or tall grass prairie regions of the United States, these ORPs are highly productive grasslands compared to more arid western rangelands. These pastures comprise about 400,000 acres (an average of about 10-11 acres per animal). Of the animals currently located in ORP, less than one percent is age 0-4 years, 49 percent are age 5-10 years, and about 51 percent are age 11+ years.

Potential impacts to wild horses from transport to adoption, sale or ORP are similar to those previously described. One difference is when shipping wild horses for adoption, sale or ORPs, 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 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.

A small percentage of the animals may be humanely euthanized if they are in very poor condition due to age or other factors. Horses residing on ORP facilities live longer, on the average, than wild horses residing on public rangelands, and the natural mortality of wild horses in ORP 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).

Cumulative Effects

Cumulative Effects of the No-Action Alternative
Under the No-Action Alternative, the wild horse population within the HMA could exceed 409 in three years. Continued and expanded movement outside the HMA would be expected as greater numbers of horses search for food and water for survival, thus impacting larger areas of public lands and threatening public safety in search of forage. Heavy to Severe utilization of the available forage would continue to be expected and the water available for use would become increasingly limited. Ecological plant communities would continue to be damaged to the extent that they would no longer be sustainable, and the wild horse population would be expected to crash; this result would be expedited under drought conditions. As wild horse populations continue to increase within and outside the HMA, rangeland degradation intensifies on public lands.

Emergency removals could be expected in order to prevent individual animals from suffering or death as a result of insufficient forage and water. These emergency removals are occurring annually and would be expected to increase as the wild horse population grows. During emergency conditions, competition for the available forage and water increases. This competition generally impacts the oldest and youngest horses as well as lactating mares first. These groups would experience substantial weight loss and

diminished health, which could lead to their prolonged suffering and eventual death. If emergency actions are not taken when emergency conditions arise, the overall population could be affected by severely skewed sex ratios towards stallions as they are generally the strongest and healthiest portion of the population. An altered age structure would also be expected.

Cumulative effects of the No-Action alternative would result in foregoing the opportunity to improve rangeland health and to properly manage wild horses in balance with the available forage and water and other multiple uses. Attainment of site-specific vegetation management objectives and Standards for Rangeland Health would not be achieved. AML would not be achieved.

Cumulative Effects of Alternatives A (Proposed Action) and Alternative B
In the future, application of population growth suppression techniques (i.e. PZP, PZP-22, GonaCon) and adjustment in sex ratios would be expected to slow total population growth rates, and to result in fewer gathers with less frequent disturbance to individual wild horses and the herd's social structure. However, return of wild horses back into the HMA could lead to decreased ability to effectively gather horses in the future as released horses learn to evade gather operations. The effect may be reduced gather effectiveness and the ability to capture a smaller portion of the population with each consecutive operation.

A gather would ultimately benefit wild horses and rangeland resources. During gather operations, wild horses would be provided adequate feed and water at temporary and short-term holding. Removal of excess wild horses would allow for reduced competition for the remaining resources left on the range. Removal of excess wild horses would ensure that individual animals do not perish due to starvation, dehydration, or other health concerns related to insufficient feed and water and extreme dust conditions. Additionally, a gather would remove excess wild horses while they remain in adequate health to transition to feed.

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, ORCs, adoption or sale with limitations and about 8% per year associated with ORPs. 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 (Stephen Jenkins, 1996, 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 Complex 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 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.

Wilderness Study Area (WSA)

Affected Environment
A wild horse herd has been present in this area since at least the early 1950s. The HMA is overlapped by portions of the Stallion SMA and the Stallion WSA. The present herd consists of approximately 230 horses (adults and yearlings) with 40% of the herd animals located within the WSA on a year-round basis. The Stallion WSA overlaps approximately 7,800 acres of public land within the Bordo Atravesado Herd Management Area, which is about 40% of the total acreage of the HMA. In accordance with the Interim Management Policy for Lands under Wilderness Review (IMP), the BLM takes into account the fact that wild horse and burro numbers fluctuate dramatically within WSAs due to a variety of factors. The BLM, however, is required to make every effort not to allow wild horse populations within the WSA to degrade either wilderness values or vegetative cover as it existed on the date of the passage of FLPMA. Wild horses must be managed at appropriate management levels as determined by monitoring activities to ensure a thriving natural ecological balance. (Wilderness values are described in detail in the New Mexico Statewide Wilderness Study, Volume 3, January, 1988.)

Livestock grazing within the WSA portion of the allotment also falls under the guidance of the IMP and is considered a grandfathered use under Section 603I of FLPMA. Grandfathered grazing use is that grazing use, including the number, kind, and class of livestock and season of use authorized and used during the 1976 grazing fee year, including areas that were in the rest cycle of a grazing system. Grandfathered uses are protected by the manner and degree clause of Section 603(c) of FLPMA. These uses must be regulated to ensure that they do not cause unnecessary or undue degradation of the lands. The manner and degree of a grazing use refers to the nature of the physical and visual impacts the use caused as of October 21, 1976, as long as the impacts of that use do not increase.

The Stallion Special Management Area (SMA) encompasses approximately 19,840 acres of public land, 1,920 of state land, and 1,080 acres are private land. Approximately 1,920 acres of the Stallion SMA is located within the Bordo Atravesado HMA. This is approximately eight percent of the SMA, and covers approximately ten percent of the HMA.

The SMA is varied in landscape, a rugged desert mountain range characterized by sheer rock escarpments, deep narrow canyons, ridges, mountain tops, broken badlands, rolling piñon-juniper, and grass covered hills. The vegetation of the SMA is typical of the upper Chihuahuan Desert at the northern extreme of its range. Vegetation types have been identified as: desert shrub, piñon-juniper, creosote, and grassland.

The Stallion SMA is being managed to protect and rehabilitate this critical watershed area. Erosion is being controlled by minimizing surface disturbance, closure and rehabilitation of unneeded roads when additional inventory is complete and monitoring and control of off road vehicle use.

Environmental Effects

No-Action Alternative
No direct impacts to wilderness values would occur. However, impacts to wilderness values of naturalness could be threatened through the continued population growth of wild horses. The WSA currently receives slight-moderate use by wild horses during certain times of the year. Increasing wild horse populations would be expected to further degrade the condition of vegetation and soil resources.

The sight of heavy horse trails, trampled vegetation and areas of high erosion would continue to detract from the wilderness experience within the WSA.

Alternatives A (Proposed Action) and Alternative B
No surface impacts within the WSA are anticipated to occur during the gather since all gather sites and holding facilities would be placed outside wilderness. However, wilderness values of naturalness would remain at or near the current condition. Under Alternative A (Proposed Action) wilderness values of naturalness after the gather would be enhanced by a reduction in wild horse numbers as a result of an improved ecological condition of the plant communities and other natural resources.

Cumulative Effects

Cumulative Effects No-Action Alternative
No direct impacts to wilderness values would occur. However, impacts to wilderness values of naturalness could be threatened through the continued population growth of wild horses. Increasing wild horse populations would be expected to further degrade the condition of vegetation and soil resources. The sight of heavy horse trails, trampled vegetation and areas of high erosion would continue to detract from the wilderness experience within the WSA.

Cumulative Effects of Alternatives A (Proposed Action) and Alternative B
There would be no new impacts to wilderness values under these alternatives. The proposed level of wild horse grazing would be the same as it was in 1989 under the Socorro RMP. No new improvement management facilities or grazing increases are proposed under these alternatives; it is in conformance with the Interim Management Policy and Guidelines for Lands Under Wilderness Review (IMP). Impacts on wild horse grazing and wilderness values were also analyzed in the New Mexico Statewide Wilderness Study document, Volume 3: Appendices Wilderness Analysis Reports, published January,1988 (Bureau of Land Management). There would be no overall change to the VRM classes. Site-specific areas where cattle and wild horses concentrate, however, such as around waters, would continue to be of a lower scenic quality. Primitive recreation opportunities would also be reduced where cattle and wild horses concentrate.

The BLM must also balance the livestock use within the portion of the WSA that is located within the HMA, in accordance with the IMP and FLPMA as the livestock use is considered a multiple use under FLPMA.Livestock and wild horse grazing management would continue to fall under the guidance of the IMP within the WSA.

Livestock Grazing

Affected Environment
The HMA is located within the Bordo Atravesado grazing allotment, #01254. The allotment permits yearlong grazing with a carrying capacity of 273 Cattle Year Long (CYL), or 3,276 animal-unit-months (AUMs), at 83% public land.

Livestock are rotated among five pastures on the allotment and managed through an approved Allotment Management Plan (AMP). Pasture management is accomplished under a flexible deferred rotation system which varies the season of use within the pastures. Deferred or rest rotation allows for plant growth and development of key forage species and is considered a Best Pasture Management tool. Conflicts arise between the wild horse herd and the present livestock operation. Livestock feed supplementation has been utilized on this allotment to meet the nutritional needs of the permittee's livestock; however, the wild horses often avail themselves of the feed. Horses have been known to kick and injure livestock

while feeding. The wild horse herd is not subject to the same deferred rotation system as are the livestock. Therefore, grazing by horses is within each pasture year-round.

Environmental Effects

No-Action Alternative
Livestock would not be displaced or disturbed as a result of gather operations under the No-Action Alternative, however, there would be continued competition with excess numbers of wild horses for limited water and forage resources. As wild horse numbers continue to increase, livestock grazing within the HMA may be further reduced in an effort to slow the deterioration of the range to the greatest extent possible.

Alternatives A (Proposed Action) and Alternative B
Under Alternative A (Proposed Action) and Alternative B, competition between livestock and wild horses for water and forage resources would be reduced over time. Forage availability and quality would improve over time as the wild horse population is incrementally brought to low or mid AML. These effects would be extended by population growth control measures.

Cumulative Effects

Cumulative Effects of the No-Action Alternative
Under the No-action alternative, wild horse populations would continue to increase. This continually increasing competition for available forage and water resources would lead to increased resource utilization. Where standards are being achieved, it is possible they would change to not achieving the standard. Opportunities to improve rangeland health, by bringing the wild horse population to AML and reducing resource competition and utilization, would be lost.

Cumulative Effects of Alternatives A (Proposed Action) and Alternative B
Under these alternatives there would be no long-term effect on domestic livestock. Reaching the AML and maintaining the horse population at this level would allow for an adequate forage supply in both quantity and quality for livestock. Temporary stress which could occur in conjunction with gathering operations would be minimized or avoided by careful attention to timing and location of activities and close communication with the grazing permittee. No adverse effects to domestic livestock are anticipated.

Under these alternatives, increasing horse populations would first displace livestock in the HMA, and then over time in adjacent areas surrounding the HMA. Displacement would be slow and indirect. As competition for forage and water increased, it would become less economically favorable to utilize the areas with domestic livestock. Authorized livestock grazing would be reduced or eliminated. This would have a negative economic impact on the livestock producers. Range conditions in and around the HMA would deteriorate significantly. Alternative B would be similar to the Proposed Action, but would not be as long lasting because the reproductive rates of the wild horse would not be reduced or controlled indefinitely.

Soils, Watershed, and Hydrology

Affected Environment
Several soil types are found within the HMA (see Table 3). The *General Soil Map for Socorro County* (USDA-SCS, 1984) refers to the dominant soils within the allotment. The Turney-Yesum-Wink soil is a deep soil, found primarily on fan terraces, bajadas, and plains. The Harvey-Winona-Netoma soil complex varies from a deep soil to a very shallow soil on bajadas, fan terraces, hills, plains, and cuestas.

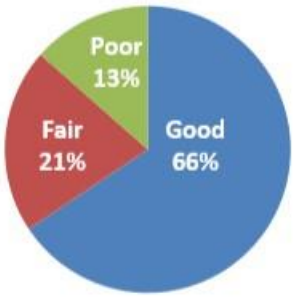
Table 3: Soil Properties of Bordo Atravesado Allotment/HMA

Soil Type	Permeability	Available Water Capacity	Rooting Depth (inches)	Runoff Speed	Water Erosion Hazard	Blowing Soil Hazard
Turney	Moderate	High	60	Slow	Slight	High
Yesum	Moderate	Low	60	Slow to Medium	Slight to Moderate	Very High
Wink	Moderately Rapid	Moderate	60	Slow	Slight	Very High
Winona	Moderate	Very Low–7 - 20	Rapid	High	Moderate	
Netoma	Moderate	High	60	Medium	Moderate	High
Harvey	Moderate	Very Low	60	Medium	Moderate	High

The ecological condition ranges from early-seral (poor) to late-seral (good).

Table 4: Range Conditions on the Bordo Atravesado Allotment

Condition	Percent	Acres
Good	65.65%	12,870
Fair	20.85%	4,088
Poor	13.50%	2,647
TOTALS	**100.00%**	**19,605**



It is anticipated that no significant disturbance of the soils would occur. Ecological processes including the hydrologic cycle, nutrient cycle, and energy flow should be maintained or improved because of stable soils and vegetation conditions within the HMA. These conditions should also support infiltration and reduce sediment yield.

Environmental Effects

No-Action Alternative
Soils and watersheds would continue to have horse use and as horse populations increase heavy trailing and trampling around water sources and to foraging areas would occur. Watershed objectives would not be met due to increased horse populations over time.

Alternatives A (Proposed Action) and Alternative B
Project implementation would stay on existing roads, washes and horse trail areas, and would disturb relatively small areas used for gathering and holding operations. Horses may be concentrated for a limited period of time in traps. Potential for soil compaction would occur but would be minimal and temporary and is not expected to adversely impact soil or hydrologic function. Soils and watersheds would remain at or near the current condition. However, soils and watersheds would likely see more improvement over time since wild horse population would be gathered in increments and growth rates would be less under this alternative.

Cumulative Effects

Cumulative Effects of the No-Action Alternative
Under the No-Action Alternative, no incremental gather-associated effects would occur to soils/watersheds, thus the declining conditions from compaction, erosion, and consequent poor vegetation support would continue to increase as horse populations increase.

Cumulative Effects of Alternatives A (Proposed Action) and Alternative B
Effects to soils would be similar to those described above for past and present actions, as these activities are expected to continue into the future. Direct cumulative effects from Alternative A (Proposed Action) and Alternative B would include the short-term incremental impact of disturbance and compaction from hoof action around horse corrals. However, the long-term incremental impact to soil resources/watersheds would be positive as the number of horses are decreased with this gather and over time with subsequent gathers. This would result in restored soil structure, increased stability, and improved biological function of soils resulting in increased water-holding capacity, reduced erosion and enhanced vegetation community support.

Wildlife

Affected Environment
The allotment contains a diverse population of wildlife. Wildlife species known to occur in the area are elk, mule deer, pronghorn, coyotes, and various reptiles, rodents, raptors, and songbirds. For a complete list of species for this allotment, refer to the Integrated Habitat Inventory Classification System, which is on file at the SFO. Sixty-three AUMs are allocated to wildlife within the HMA. No threatened, endangered or proposed threatened, endangered species are known to be present in the HMA.

The Taylor Grazing Act (TGA) of 1934 implemented the adjudication of grazing privileges which comply with the Federal Range Code for grazing, 43 CFR 4100. Wildlife was also considered in the process, and historically, AUMs were allocated. This does not, however, accurately reflect the amount of forage available to wildlife.

The grazing strategy allows for an average utilization of 50 percent of the key species. This utilization level does not differentiate between use by livestock, wildlife or wild horses. The remaining vegetation is available for plant health and reproduction, soil protection, and other resources such as wildlife cover. Adhering to the allowable use of 50 percent ensures that there will continue to be sufficient forage for livestock, wildlife, and wild horses.

Environmental Effects

No-Action Alternative
Increased use over the HMA would adversely impact soils and vegetation health. As native plant health deteriorates and plants are lost, soil erosion increases. Range conditions in and around the HMA would deteriorate significantly. These effects would be cumulative over time. There would be increased impacts to areas outside the HMA as horses move out in search of better forage. These impacts would have a negative effect on wildlife cover, forage, and movements within the area.

Alternatives A (Proposed Action) and Alternative B
Under Alternative A (Proposed Action) there would be positive and negative impacts to wildlife. As mentioned above, the removal of horses from the area would avoid potential over-utilization of forage and reduction in vegetative ground cover.

Wild horse grazing has both direct and indirect impacts to the wildlife community in the area. Wild horses compete directly with large ungulate grazers such as elk for forage. Wild horses can also compete directly with grazers and browsers such as pronghorn and mule deer during early spring when new growth is limited. Wild horses can also facilitate vegetation use by these species by removing large coarse material from plants, allowing the smaller ungulates to utilize a more nutritious portion of the plant. In so-called sacrifice areas, primarily near water developments and areas of terrain favorable to cattle movement, heavier rates of use on grass species can cause an increase in the proportion of forbs in the vegetation composition as these annuals invade these sites. This change in the plant community in small areas has a beneficial impact on foraging by species such as pronghorn and mule deer which prefer these plants to coarser grasses.

Both negative and positive impacts to wildlife species can occur as horse and cattle grazing impacts vegetative cover. Negative impacts to bird and rodent species that depend on grass seeds as a major component of their diet can occur if horse and livestock grazing use does not allow for a percentage of plants to complete their full life cycle. A decrease in vertical structure of grassland vegetation can negatively impact ground nesting birds, small rodents, and reptile species by reducing cover for protection from weather and predators. Conversely, a reduction in cover in some areas can facilitate foraging by ground dwelling species that are able to more easily move in less dense vegetative stands. A reduction in overhead cover can also favor predator species that hunt by sight and potentially improve their foraging success. Grassland communities can also have accelerated rates of invasion by woody species of trees and shrubs if these communities were historically maintained by fire carried by grass biomass. This conversion can have detrimental impacts to the wildlife species dependent on the grassland community but favorable impacts to wildlife species adapted to shrub and tree environments.

Predatory species can also be impacted both directly and indirectly by wild horse grazing. The presence of wild horses on the range provides an additional food source for large predators such as mountain lions and coyotes. The ability to utilize wild horses may maintain large predator numbers at higher than historic levels when natural factors such as drought and wild ungulate population declines may have historically led to predator declines. This, in turn, can lead to increased predation levels on wild prey species, preventing recoveries from natural climate fluctuations. If impacts to wild horses become severe enough that predator management strategies are implemented, direct negative impacts can result to local predator populations. Analysis in NEPA documents prepared by the U.S. Department of Agriculture has shown that these impacts are short term, and in the long term there is no impact to population viabilities. Suppression of large predators for horse and livestock protection can lead to an increase in smaller predators which may have been reduced by direct competition and predation from larger predators.

Grazing strategies implemented by the SFO strive to ensure that a sufficient percentage of grass plants complete their full life cycle for seed availability. A reduction in grass species in some localized areas from grazing can be positive if invader species of plants are seed producing annuals that may produce more available seeds for use by wildlife. Grazing management that allows for diversity in the levels of use within an area can provide for both wildlife protection and predator success. Grazing management that strives for a uniform level of use over an entire area does not provide for this diversity. The detrimental impacts to the wildlife species dependent on the grassland community but impacted by shrub and tree encroachment can be overcome by recognizing the need for management ignited fires to simulate historic periodic wildfires.

Cumulative Effects

Cumulative Effects of the No Action Alternative

The cumulative impacts from the No Action Alternative, in addition to past, present and reasonably foreseeable future actions would result in continual degradation of habitat for all wildlife. Horses would

continue to be above AML and compete for resources with other wildlife and livestock. Breeding, foraging, nesting and security habitat for all species would continue to degrade.

Cumulative Effects of the Alternative A (Proposed Action) and Alternatives B
Impacts to wildlife habitat within the HMA have resulted from past and present actions such as livestock grazing, road maintenance, recreation, and wild horses. The cumulative impacts from the Proposed Action, in addition to past, present and reasonably foreseeable future actions would be beneficial for all wildlife and their habitat. With a reduction of horse numbers, habitat within the HMA and surrounding area would have the opportunity to improve. Impacts to vegetation would be reduced, allowing for recovery. Breeding, forage, nesting, and security habitat for all species would improve over time.

Vegetation

Affected Environment
The HMA is located within the Pecos-Canadian Plains and Valleys Major Land Resource Area (MLRA) and the Southern Desertic Basins, Plains and Mountains MLRA. Upland areas consist of scattered piñon-juniper (Pinus edulis and Juniperus osteosperma) with a mixture of vegetation including black grama (Bouteloua eripoda), New Mexico feather grass (Stipa neomexicana) blue grama (B. gracilis), sideoats grama (B. curtipendula), galleta (Hilaria jamesii), sand dropseed (Sporobolus cryptandrus), bottlebrush squirreltail (Sitanion hystrix), Indian ricegrass (Oryzopsis hymenoides), wolftail (Lycurus phleoides), winterfat (Krascheninnikovia lanata), mountain mahogany (Cercocarpus montanus) and sumac (Rhus trilobata). Encroachment by piñon-juniper is increasing based on the number of younger trees in the area. Lowland areas are occupied by blue grama, alkali sacaton (Sporobolus arioides), giant sacaton (S.wrightii), burrograss (Scleropogon brevifolius), ring muhly (Muhlenbergia torreyi), sand dropseed, mesa dropseed (S. flexuosus), cholla (Opuntia imbricata), sideoats grama, black grama, winterfat, and juniper. Some areas may also contain gyp dropseed (S. nealleyi) and coldenia (Coldenia hispidissima).

Frequency studies were instituted in 1981, and data indicate improvement in the area. The data also show an increase in species diversity on the allotment; skunkbush, algerita, fourwing saltbush, winterfat, and sideoats grama have either appeared or increased in the last 23 years. Piñon-juniper has also increased based on frequency data.

Current monitoring data show utilizations levels on key species are heavy to severe. Previous years data show utilizations levels moderate to heavy.

The weather conditions have not been favorable for the past few years. The average annual precipitation for the state of New Mexico is 13.85 inches. The area has been dry with very little moisture during 2020 and 2021 (See Table 5).

Table 5: Local Annual Precipitation (inches)

Weather Station Location	2020	2021
Sierra Larga Allotment East	5.5	6.25
Bosque Del Apache	6.24	8.76
Chupadera	7.08	10.78
Socorro Airport	5.31	8.45
Average	**6.03**	**8.56**

Environmental Effects

No-Action Alternative
No impacts from the gather would occur. Wild horse populations would remain over appropriate management levels. The impacts to vegetation by grazing or trampling would increase more exponentially and would result in deterioration in plant health, reproduction, diversity, and composition. As plants deteriorate, they would not be able to reproduce or recover. By reducing opportunities for photosynthetic processes, the plants would be susceptible to over grazing and other stressors, such as drought, and entire plant communities could die out, allowing less desired species to increase. Over time forage resources would become less available, impacting wild horse herd health, and wild horses would be more susceptible to disease and drought.

Alternatives A (Proposed Action) and Alternative B
Alternative A (Proposed Action) is expected to have an effect on vegetative resources including trampling of vegetation by wild horses at gather sites and holding locations; and crushing of vegetation by vehicles, temporary corrals and holding facilities. These disturbed areas would be less than one acre in size. Gather corrals and holding facility locations are usually placed in areas easily accessible to livestock trailers and standard equipment, utilizing roads, gravel pits or other previously disturbed sites and accessible by existing roads. No new roads would be created. These impacts are temporary, and vegetation is expected to recover within the next growing season.

Achieving and maintaining the established AML would benefit the vegetation by reducing the grazing pressure on the forage resources. Forage utilization would be reduced. Defoliation that occurs more than once in a growing season reduces a plant's ability to maintain plant health and reproduce (Herbel 2004). The impacts to vegetation by grazing or trampling based on the reduction in wild horse numbers to AML would result in maintaining or improving plant health, reproduction, diversity, and composition by allowing the plants to maintain and continue photosynthetic processes to initiate regrowth for recovery and grow adequately for reproduction. Achieving and maintaining the established AMLs throughout the HMA would be expected to result in upward trends in vegetation health, increased vigor, production and frequency of key forage species, and attainment of Rangeland Health Standards.

Cumulative Effects of the No-Action Alternative
Increased use over the HMA would adversely impact soils and vegetation health. As native plant health deteriorates and plants are lost, soil erosion increases. Invasive plant species would increase and invade new areas following increased soil disturbance and reduced native plant vigor and abundance. These impacts would be cumulative over time. There would be increased impacts to areas outside the HMA as horses move out in search of better forage.

Cumulative Effects of Alternatives A (Proposed Action) and Alternative B
The removal of excess wild horses from the herd area would avoid potential over-utilization of forage and reduction in vegetative ground cover. At the established AML's, utilization by the wild horses would be reduced, which would result in improved forage availability, improved vegetation density, increased vegetation cover, increased plant vigor, and improved seed production, seedling establishment, and forage production over current conditions. Competition for forage among wild horses, wildlife, and livestock would be reduced as utilization levels decrease and rangeland health improves, thereby promoting healthier habitat and healthier animals. Reduced concentrations of wild horses would contribute to the recovery of vegetative resource. Physical damage to shrubs and herbaceous vegetation associated with the physical passage of horses would be decrease.

PRESENT ACTIONS

Today the Bordo Atravesado HMA has an estimated population is at least 230 wild horses (based on the 2022 aerial survey). Resource damage is occurring in portions of the HMA due to excess animals. Current BLM policy is to conduct removals targeting portions of the wild horse population based upon age and allowing the correction of any sex ratio problems that may occur. Further, the BLM's policy is to conduct gathers in order to facilitate a four-year gather cycle and to reduce population growth rates where possible. Program goals have expanded beyond establishing a "thriving natural ecological balance" by setting AML for individual herds to now include achieving and maintaining healthy and stable populations and controlling population growth rates. Though authorized by the WFRHBA, current appropriations and policy prohibit the destruction of healthy animals that are removed or deemed to be excess. Only sick, lame, or dangerous animals can be euthanized, and destruction is no longer used as a population control method. A recent amendment to the WFRHBA allows the sale of excess wild horses that are over 10 years in age or have been offered unsuccessfully for adoption three times. BLM is adding additional long-term grassland pastures in the Midwest and West to care for excess wild horses for which there is no adoption or sale demand. The BLM is continuing to administer grazing within the Bordo Atravesado Allotment. Within the proposed gather area cattle grazing occurs on a yearly basis. Wildlife use by large ungulates such as elk, deer, and antelope are also currently common in the HMA. The focus of wild horse management has also expanded to place more emphasis on achieving rangeland health as measured against the RAC Standards. Adjustments to numbers, season of use, grazing season, and allowable use are based on evaluating achievement of or making progress toward achieving the standards.

RESONABLY FORSEEABLE FUTURE ACTIONS

Past actions regarding the management of wild horses have resulted in the current wild horse population within the Bordo Atravesado Herd Management Area. Wild horse management has contributed to the present resource condition and wild horse herd structure within the gather area. The combination of the past, present, and reasonably foreseeable future actions, along with Alternative A (Proposed Action), should result in more stable and healthier wild horse populations, healthier rangelands (vegetation, and wildlife habitat), and fewer multiple-use conflicts within the HMA.

MONITORING AND MITIGATION MEASURES

Proven mitigation and monitoring are incorporated into Alternative A (Proposed Action) through SOPs, which have been developed over time. These SOPs (Appendix A, D) represent the "best methods" for reducing impacts associated with gathering, handling, and transporting wild horses and collecting herd data. Hair follicle samples would be collected to continue to determine trend. If monitoring indicates that genetic diversity (as measured in terms of observed heterozygosity) is not being adequately maintained, 2-4 young mares from HMAs in similar environments may be added every generation (every 8-10 years) to avoid inbreeding depression and to maintain acceptable genetic diversity. Ongoing resource monitoring, including climate (weather), and forage utilization, population inventory, and distribution data would continue to be collected.

Public Scoping

Diane Del Curto Grazing Permittee
Oregon Wild Horse Organization
The Cloud Foundation
Friends of Animals
American Wild Horse Campaign
Wild Horse Observers Association (WHOA)
Illeana Ceresuolo
Carolyn Borkowski
Laurie Ford
Raquel Morgan-Finch

Tammi Adams
Kim Sheppard
Belinda Price
Joy Burk
Jannet Hackert
Kate Mabry
Eileen Hennessy
Barbara Wright
Rebecca Falk
Heidi Snell
Craig Downer
Beth Hubbard
Liz Cook
Barbara Kiipper

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REFERENCES AND ACRONYMS

General References Cited

Amberg, S., K. Kilkus, M. Komp, A. Nadeau, K. Stark, L. Danielson, S. Gardner, E. Iverson, E. Norton, and B. Drazkowski. 2014. Theodore Roosevelt: National Park: Natural resource condition assessment. Natural Resource Report NPS/THRO/NRR—2014/776. National Park Service, Fort Collins, Colorado.

American Association of Equine Practitioners (AAEP). 2011. Bureau of Land Management (BLM) Wild Horse and Burro Program, Task Force Report, August 2011, Lexington, KY.

Ashley, M.C., and D.W. Holcomb. 2001. Effect of stress induced by gathers and removals on reproductive success of feral horses. Wildlife Society Bulletin 29: 248-254.

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

Bartholow, J.M. 2004. An economic analysis of alternative fertility control and associated management techniques for three BLM wild horse herds. USGS Open-File Report 2004-1199.

Bureau of Land Management (BLM). 2015. Comprehensive animal welfare program for wild horse and burro gathers. Instruction Memorandum (IM) 2015-151.

Carey, K.A., A. Ortiz, K. Grams, D. Elkins, J.W. Turner, and A.T. Rutberg. 2019. Efficacy of dart-delivered PZP-22 immunocontraceptive vaccine in wild horses (Equus caballus) in baitedtraps in New Mexico, USA. Wildlife Research 46:713-718.

Cothran, E.G. 2013. Genetic Analysis of Bordo Atravesado HMA, NM0001. Report to BLM from Department of Veterinary Integrative Bioscience, Texas A & M University.

Curtis, P.D., Pooler, R.L., Richmond, M.E., Miller, L.A., Mattfield, G.F., Quimby, F.W. 2002. Comparative effects of GnRH and porcine zona pellucid (PZP) immunocontraception vaccines for controlling reproduction in white-tailed deer (Odocoileus virginianus). ReproductionSupplement 60:131-141.

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

EPA. 2009b. Memorandum on GonaCon ™ Immunocontraceptive Vaccine for Use in White-TailedDeer. Section 3 Registration. US Environmental Protection Agency, Washington, DC.

Environmental Protection Agency (EPA). 2012. Porcine Zona Pellucida. Pesticide fact Sheet. Office of

Garrot. R. A., and I. Taylor. 1990. Dynamics of a feral horse population in Montana. Journal ofWildlife Management 54:603-612.

Government Accountability Office (GAO). 2008. Bureau of Land Management; Effective Long-Term Options Needed to Manage Unadoptable Wild Horses. Report to the Chairman, Committee on Natural Resources, House of Representatives, GAO-09-77.

Greene, E.A., C.R. Heleski, S.L. Ralston, and C.L Stull. 2013. Academic assessment of equine welfare during the gather process of the Bureau of Land Management's wild horse and burroprogram. Journal of Equine Veterinary Science 5: 352-353.

Griffin, P.C., L.S. Ekernas, K.A. Schoenecker, and B.C. Lubow. 2020. Standard operating procedures forwild horse and burro double-observer aerial surveys. U.S. Geological Survey Techniques and Methods, book 2, chap. A16, 76 pages. https://doi.org/10.3133/tm2A16.

Hansen, K.V., and J.C. Mosley. 2000. Effects of roundups on behavior and reproduction of feral horses. Journal of Range Management 53: 479-482.

Heilmann, T.J., Garrott, R.A., Caldwell, L.L., Tiller, B.L. 1998. Behavioral response of free-ranging elk treated with an immunocontraceptive vaccine. Journal of Wildlife Management 62:243-250.

Interior Board of Land Appeals 88-591, 88-638, 88-648, 88-679 at 127.Animal Protection Institute of America v. Nevada BLM, 109 IBLA 115, (1989). Animal Protection Institute, 118 IBLA 63,

75 (1991).
Jenkins, S.H. 1996. Wild horse population model version 3.2. User's Guide. Department of Biology, University of Nevada, Reno, Nevada.
Killian, G., D. Thain, N.K. Diehl, J. Rhyan, and L. Miller. 2008. Four-year contraception rates ofmares treated with single-injection porcine zona pellucida and GnRH vaccines and intrauterine devices. Wildlife Research 35:531-539.
McCann, B., D. Baker, J. Powers, A. Denicola, B. Soars, and M. Thompson. 2017. Delivery of GonaCon-Equine to feral horses (Equus caballus) using prototype syringe darts. Presentation to the International Wildlife Fertility Control conference, Washington, D.C.
Miller, L.A., K.A. Fagerstone, and D.C. Eckery. 2013. Twenty years of immune contraceptive research: lessons learned. Journal of Zoo and Wildlife Medicine 44:S84-S96.
Muñoz, D.A., P.S. Coates, and M.A. Ricca. 2020. Free-roaming horses disrupt greater sage-grouse lekking activity in the great basin. Journal of Arid Environments 184: 104304.
National Research Council of the National Academies of Sciences (NAS). 2013. Using science to improve the BLM wild horse and burro program: a way forward. National Academies Press. Washington, DC.
Powell, D.M. 1999. Preliminary evaluation of porcine zona pellucid (PZP) immunocontraception forbehavioral effects in feral horses (Equus caballus). J. Appl. Anim. Welfare Sci. 2:321-335.
Ransom JI, Cade BS, Hobbs NT. 2010. Influences of immunocontraception on time budgets, social behavior, and body condition in feral horses. Appl. Anim. Behavior Sci. 124:51-60.
Ransom, J.I., L Lagos, H. Hrabar, H. Mowrazi, D. Ushkhjargal, and N. Spasskaya. 2016. Wild and feral equid population dynamics. Pages 68-86 in J. I. Ransom and P Kaczensky, eds., Wild equids; ecology, management and conservation. Johns Hopkins University Press, Baltimore, Maryland.
Rutberg, A., K. Grams, J.W. Turner, and H. Hopkins. 2017. Contraceptive efficacy of priming andboosting does of controlled-release PZP in wild horses. Wildlife Research: http://dx.doi.org/10.1071/WR16123
Scasta, J.D. 2019. Mortality and operational attributes relative to feral horse and burro capture techniques based on publicly available data from 2010-2019. Journal of Equine VeterinaryScience, 102893.
Science and Conservation Center (SCC). 2015. Materials Safety Data Sheet, ZonaStat-H. Billings, Montana.
Smith, M.A. 1986a. Impacts of Feral Horses Grazing on Rangelands: An Overview. Equine Veterinary Science, 6(5):236-238.
Smith, M.A. 1986b. Potential Competitive Interactions Between Feral Horses and Other GrazingAnimals. Equine Veterinary Science, 6(5):238-239.
Turner, J.W. and M.L. Morrison. 2001. Influence of predation by mountain lions on numbers and survivorship of a feral horse population. The Southwestern Naturalist 46:183-190.
Turner, J.W. 2015. Environmental influences on movements and distribution of a wild horse (Equus caballus) population in western Nevada, USA: a 25-year study. Journal of Natural History 49 (39-40):2437-2464.
Wang-Cahill, F., J. Warren, T. Hall, J' O'Hare, A. Lemay, E. Ruell, and R. Wimberly. In press. Use of GonaCon in wildlife management. Chapter 24 in USDA-APHIS, Human health and ecological risk assessment for the use of wildlife damage management methods by APHIS- Wildlife Services. USDA APHIS, Fort Collins, Colorado.
Zoo Montana. 2000 Wildlife Fertility Control: Fact and Fancy. Zoo Montana Science and Conservation Biology Program, Billings, Mt.

CITATIONS ABOUT PZP, GONACON, and SEX RATIO

Asa, C.S., D.A. Goldfoot, M.C. Garcia, and O.J. Ginther. 1980. Sexual behavior in ovariectomized and seasonally anovulatory pony mares (*Equus caballus*). Hormones andBehavior 14:46-54.

Ashley, M.C., and D.W. Holcombe. 2001. Effects of stress induced by gathers and removals on reproductive success of feral horses. Wildlife Society Bulletin 29:248-254.

Baker, D.L., J.G. Powers, M.O. Oehler, J.I. Ransom, J. Gionfriddo, and T.M. Nett. 2013. Field evaluation of the Immunocontraceptive GonaCon-B in Free-ranging Horses (*Equus caballus*) at Theodore Roosevelt National Park. Journal of Zoo and Wildlife Medicine 44:S141-S153.

Baker, D.L., J.G. Powers, J. Ransom, B. McCann, M. Oehler, J. Bruemmer, N. Galloway, D. Eckery, and T. Nett. 2017. Gonadotropin-releasing hormone vaccine (GonaCon-Equine) suppresses fertility in free-ranging horses (*Equus caballus*): limitations and side effects. Proceedings of the 8th International Wildlife Fertility Control Conference, Washington, D.C.

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

Balet, L., F. Janett, J. Hüsler, M. Piechotta, R. Howard, S. Amatayakul-Chantler, A. Steiner, and G. Hirsbrunner, 2014. Immunization against gonadotropin-releasing hormone in dairy cattle: Antibody titers, ovarian function, hormonal levels, and reversibility. Journal of Dairy Science 97:2193-2203.

Bagavant, H., C. Sharp, B. Kurth, and K.S.K. Tung. 2002. Induction and immunohistology of autoimmune ovarian disease in cynomolgus macaques (Macaca fascicularis). American Journal of Pathology 160:141-149.

Barber, M.R., and R.A. Fayer-Hosken. 2000. Evaluation of somatic and reproductive immunotoxic effects of the porcine zone pellucida vaccination. Journal of Experimental Zoology 286:641-646.

Bartholow, J.M. 2004. An economic analysis of alternative fertility control and associated management techniques for three BLM wild horse herds. USGS Open-File Report 2004-1199.

Bartholow, J. 2007. Economic benefit of fertility control in wild horse populations. The Journalof Wildlife Management 71:2811-2819.

Bechert, U., J. Bartell, M. Kutzler, A. Menino, R. Bildfell, M. Anderson, and M. Fraker. 2013. Effects of two porcine zona pellucida immunocontraceptive vaccines on ovarian activity inhorses. The Journal of Wildlife Management 77:1386-1400.

Bechert, U.S., and M.A. Fraker. 2018. Twenty years of SpayVac research: potential implication for regulating feral horse and burro populations in the United States. Human-Wildlife Interactions 12:117-130.

Boedeker, N.C., L.A.C. Hayek, S. Murray, D.M. De Avila, and J.L. Brown. 2012. Effects of a gonadotropin-releasing hormone vaccine on ovarian cyclicity and uterine morphology of an Asian elephant (Elephas maximus). Journal of Zoo and Wildlife Medicine 43:603-614.

Bohrer, B.M., W.L. Flowers, J.M. Kyle, S.S. Johnson, V.L. King, J.L. Spruill, D.P. Thompson, A.L. Schroeder, and D.D. Boler. 2014. Effect of gonadotropin releasing factor suppression with an immunological on growth performance, estrus activity, carcass characteristics, and meat quality of market gilts. Journal of Animal Science 92:4719-4724.

Botha, A.E., M.L. Schulman, H.J. Bertschinger, A.J. Guthrie, C.H. Annandale, and S.B. Hughes.2008. The use of a GnRH vaccine to suppress mare ovarian activity in a large group of mares under field conditions. Wildlife Research 35:548-554.

Bureau of Land Management (BLM). 2010. BLM-4700-1 Wild Horses and Burros Management Handbook. Washington, D.C.

Bureau of Land Management (BLM). 2015. Instruction Memorandum 2015-151; Comprehensive animal welfare program for wild horse and burro gathers. Washington, D.C.

Carey, K.A., A. Ortiz, K. Grams, D. Elkins, J.W. Turner, and A.T. Rutberg. 2019. Efficacy ofdart-delivered PZP-22 immunocontraceptive vaccine in wild horses (Equus caballus) in baited traps in New Mexico, USA. Wildlife Research 46:713-718.

Coit, V.A., F.J. Dowell, and N.P.Evans. 2009. Neutering affecTS MRNA expression levels for theLH- and GnRH-receptors in the canine urinary bladder. Theriogenology 71:239-247.

Cooper, D.W. and C.A. Herbert. 2001. Genetics, biotechnology and population management ofover-abundant mammalian wildlife in Australasia. Reproduction, Fertility and Development, 13:451-458.

Cooper, D.W. and E. Larsen. 2006. Immunocontraception of mammalian wildlife: ecological and immunogenetic issues. Reproduction, 132, 821–828.

Cothran, E.G. 2013. Genetic Analysis of Bordo Atravesado HMA, NM0001. Report to BLM from Department of Veterinary Integrative Bioscience, Texas A & M University.

Creel, S., B. Dantzer, W. Goymann, and D.R. Rubenstein. 2013. The ecology of stress: effects ofthe social environment. Functional Ecology 27:66-80.

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

Curtis, P.D., R.L. Pooler, M.E. Richmond, L.A. Miller, G.F. Mattfeld, and F.W. Quimby. 2008. Physiological Effects of gonadotropin-releasing hormone immunocontraception in white-tailed deer. Human-Wildlife Conflicts 2:68-79.

Dalmau, A., A. Velarde, P. Rodríguez, C. Pedernera, P. Llonch, E. Fàbrega, N. Casal, E. Mainau, M. Gispert, V. King, and N. Slootmans. 2015. Use of an anti-GnRF vaccine to suppressestrus in crossbred Iberian female pigs. Theriogenology 84:342-347.

Dalin, A.M., Ø. Andresen, and L. Malmgren. 2002. Immunization against GnRH in mature mares: antibody titres, ovarian function, hormonal levels and oestrous behaviour. Journal of Veterinary Medicine Series A 49:125-131.de Seve, C.W. and S.L. Boyles-Griffin. 2013. An economic model demonstrating the long-term cost benefits of incorporating fertility control into wild horse (Equus caballus) managementin the United States. Journal of Zoo and Wildlife Medicine 44(4s:S34-S37).

Dong, F., D.C. Skinner, T. John Wu, and J. Ren. 2011. The Heart: A Novel Gonadotrophin-Releasing Hormone Target. Journal of Neuroendocrinology 23:456-463.

Donovan, C.E., T. Hazzard, A. Schmidt, J. LeMieux, F. Hathaway, and M.A. Kutzler. 2013. Effects of a commercial canine gonadotropin releasing hormone vaccine on estrus suppression and estrous behavior in mares. Animal Reproduction Science, 142:42-47.

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

Elhay, M., A. Newbold, A. Britton, P. Turley, K. Dowsett, and J. Walker. 2007. Suppression of behavioural and physiological oestrus in the mare by vaccination against GnRH. Australian Veterinary Journal 85:39-45.

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

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

Environmental Protection Agency (EPA). 2012. Porcine Zona Pellucida. Pesticide fact Sheet. Office of Chemical Safety and Pollution Prevention 7505P. 9 pages.

Environmental Protection Agency (EPA). 2013. Notice of pesticide registration for GonaCon-Equine. US Environmental Protection Agency, Washington, DC.
Environmental Protection Agency (EPA). 2015. Label and CSF Amendment. November 19, 2015memo and attachment from Marianne Lewis to David Reinhold. US Environmental Protection Agency, Washington, DC.
Environmental Protection Agency (EPA). 2012. Porcine Zona Pellucida. Pesticide fact Sheet. Office of Chemical Safety and Pollution Prevention 7505P. 9 pages.
Feh, C. 2012. Delayed reversibility of PZP (porcine zona pellucida) in free-ranging Przewalski'shorse mares. In International Wild Equid Conference. Vienna, Austria: University of Veterinary Medicine.
Feh, C., and B. Munkhtuya. 2008. Male infanticide and paternity analyses in a socially naturalherd of Przewalski's horses: Sexual selection? Behavioral Processes 78:335-339.
Fonner, R. and A.K. Bohara. 2017. Optimal control of wild horse populations with nonlethal methods. Land Economics 93:390-412.
French, H., E. Peterson, R. Ambrosia, H. Bertschinger, M. Schulman, M. Crampton, R. Roth, P. Van Zyl, N. Cameron-Blake, M. Vandenplas, and D. Knobel. 2017. Porcine and recombinantzona pellucida vaccines as immunocontraceptives for donkeys in the Caribbean. Proceedingsof the 8th International Wildlife Fertility Control Conference, Washington, D.C.
Garrott, R.A., and M.K. Oli. 2013. A Critical Crossroad for 'LM's Wild Horse Program. Science 341:847-848.
Garza, F., D.L. Thompson, D.D. French, J.J. Wiest, R.L. St George, K.B. Ashley, L.S. Jones, P.S. Mitchell, and D.R. McNeill. 1986. Active immunization of intact mares against gonadotropin-releasing hormone: differential effects on secretion of luteinizing hormone andfollicle-stimulating hormone. Biology of Reproduction 35:347-352.
Gionfriddo, J.P., A.J. Denicola, L.A. Miller, and K.A. Fagerstone. 2011a. Efficacy of GnRH immunocontraception of wild white-tailed deer in New Jersey. Wildlife SocietyBulletin 35:142-148.
Gionfriddo, J.P., A.J. Denicola, L.A. Miller, and K.A. Fagerstone. 2011b. Health effects of GnRH immunocontraception of wild white-tailed deer in New Jersey. Wildlife SocietyBulletin 35:149-160.
Goodloe, R.B., 1991. Immunocontraception, genetic management, and demography of feral horses on four eastern US barrier islands. UMI Dissertation Services.
Gray, ME. 2009a. The influence of reproduction and fertility manipulation on the social behaviorof feral horses (Equus caballus). Dissertation. University of Nevada, Reno.
Gray, M.E. 2009b. An infanticide attempt by a free-roaming feral stallion (Equus caballus). Biology Letters 5:23-25.
Gray, M.E., D.S. Thain, E.Z. Cameron, and L.A. Miller. 2010. Multi-year fertility reduction in free-roaming feral horses with single-injection immunocontraceptive formulations. Wildlife Research 37:475-481.
Gray, M.E. and E.Z. Cameron. 2010. Does contraceptive treatment in wildlife result in sideeffects? A review of quantitative and anecdotal evidence. Reproduction 139:45-55.
Gross, J.E. 2000. A dynamic simulation model for evaluating effects of removal and contraception on genetic variation and demography of Pryor Mountain wild horses. Biological Conservation 96:319-330.
Gupta, S., and V. Minhas. 2017. Wildlife population management: are contraceptive vaccines a feasible proposition? Frontiers in Bioscience, Scholar 9:357-374.
Hailer, F., B. Helander, A.O. Folkestad, S.A. Ganusevich, S. Garstad, P. Hauff, C. Koren, T. Nygård, V. Volke, C. Vilà, and H. Ellegren. 2006. Bottlenecked but long-lived: high geneticdiversity retained in white-tailed eagles upon recovery from population decline. Biology Letters 2:316-319.
Hampton, J.O., T.H. Hyndman, A. Barnes, and T. Collins. 2015. Is wildlife fertility control always humane? Animals 5:1047-1071.

Heilmann, T.J., R.A. Garrott, L.L. Cadwell, and B.L. Tiller, 1998. Behavioral response of free-ranging elk treated with an immunocontraceptive vaccine. Journal of Wildlife Management62: 243-250.
Herbert, C.A. and T.E. Trigg. 2005. Applications of GnRH in the control and management of fertility in female animals. Animal Reproduction Science, 88:141-153.
Hsueh, A.J.W. and G.F. Erickson. 1979. Extrapituitary action of gonadotropin-releasing hormone: direct inhibition ovarian steroidogenesis. Science 204:854-855.
Imboden, I., F. Janett, D. Burger, M.A. Crowe, M. Hässig, and R. Thun. 2006. Influence of immunization against GnRH on reproductive cyclicity and estrous behavior in the mare. Theriogenology 66:1866-1875.
Janett, F., U. Lanker, H. Jörg, E. Meijerink, and R. Thun. 2009a. Suppression of reproductive cyclicity by active immunization against GnRH in the adult ewe. Schweizer Archiv fur Tierheilkunde 151:53-59.
Janett, F., R. Stump, D. Burger, and R. Thun. 2009b. Suppression of testicular function and sexual behavior by vaccination against GnRH (Equity™) in the adult stallion. AnimalReproduction Science 115:88-102.
Jones, M.M., and C.M.V. Nuñez. 2019. Decreased female fidelity alters male behavior in a feralhorse population managed with immunocontraception. Applied Animal Behaviour Science 214:34-41.
Jones, M.M., L. Proops, and C.M.V. Nuñez. 2020. Rising up to the challenge of their rivals: mare infidelity intensifies stallion response to playback of aggressive conspecific vocalizations. Applied Animal Behaviour Science (in press): 104949.
Joonè, C.J., H.J. Bertschinger, S.K. Gupta, G.T. Fosgate, A.P. Arukha, V. Minhas, E. Dieterman,and M.L. Schulman. 2017a. Ovarian function and pregnancy outcome in pony mares following immunocontraception with native and recombinant porcine zona pellucida vaccines. Equine Veterinary Journal 49:189-195.
Joonè, C.J., H. French, D. Knobel, H.J. Bertschinger, and M.L. Schulman. 2017b. Ovarian suppression following PZP vaccination in pony mares and donkey jennies. Proceedings of the 8th International Wildlife Fertility Control Conference, Washington, D.C.
Joonè, C.J., M.L. Schulman, G.T. Fosgate, A.N. Claes, S.K. Gupta, A.E. Botha, A-M Human, and H.J. Bertschinger. 2017c. Serum anti-Müllerian hormone dynamics in mares following immunocontraception with anti-zona pellucida or -GnRH vaccines, Theriogenology (2017), doi: 10.1016/
Joonè, C.J., M.L. Schulman, and H.J. Bertschinger. 2017d. Ovarian dysfunction associated withzona pellucida-based immunocontraceptive vaccines. Theriogenology 89:329-337.
Kane, A.J. 2018. A review of contemporary contraceptives and sterilization techniques for feralhorses. Human-Wildlife Interactions 12:111-116.
Kean, R.P., A. Cahaner, A.E. Freeman, and S.J. Lamont. 1994. Direct and correlated responses to multitrait, divergent selection for immunocompetence. Poultry Science 73:18-32.
Killian, G., N.K. Diehl, L. Miller, J. Rhyan, and D. Thain. 2006. Long-term efficacy of three contraceptive approaches for population control of wild horses. In Proceedings-VertebratePest Conference.
Killian, G., D. Thain, N.K. Diehl, J. Rhyan, and L. Miller. 2008. Four-year contraception rates ofmares treated with single-injection porcine zona pellucida and GnRH vaccines and intrauterine devices. Wildlife Research 35:531-539.
Killian, G., T.J. Kreeger, J. Rhyan, K. Fagerstone, and L. Miller. 2009. Observations on the useof GonaConTM in captive female elk (Cervus elaphus). Journal of Wildlife Diseases 45:184-188.
Kirkpatrick, J.F. and J.W. Turner. 1991. Compensatory reproduction in feral horses. Journal of Wildlife Management 55:649-652.

Kirkpatrick, J.F., I.M.K. Liu, J.W. Turner, R. Naugle, and R. Keiper. 1992. Long-term effects of porcine zonae pellucidae immunocontraception on ovarian function in feral horses (Equus caballus). Journal of Reproduction and Fertility 94:437-444.

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

Kirkpatrick, J.F. and A. Turner. 2003. Absence of effects from immunocontraception on seasonal birth patterns and foal survival among barrier island wild horses. Journal of Applied AnimalWelfare Science 6:301-308.

Kirkpatrick, J.F., A.T. Rutberg, and L. Coates-Markle. 2010. Immunocontraceptive reproductive control utilizing porcine zona pellucida (PZP) in federal wild horse populations, 3rd edition. P.M. Fazio, editor. Downloaded from http://www.einsten.net/pdf/110242569.pdf Kirkpatrick, J.F., R.O. Lyda, and K. M. Frank. 2011. Contraceptive vaccines for wildlife: a review. American Journal of Reproductive Immunology 66:40-50.

Kirkpatrick, J.F., A.T. Rutberg, L. Coates-Markle, and P.M. Fazio. 2012. Immunocontraceptive Reproductive Control Utilizing Porcine Zona Pellucida (PZP) in Federal Wild Horse Populations. Science and Conservation Center, Billings, Montana.

Knight, C.M. 2014. The effects of porcine zona pellucida immunocontraception on health and behavior of feral horses (Equus caballus). Graduate thesis, Princeton University.

Levy, J.K., J.A. Friary, L.A. Miller, S.J. Tucker, and K.A. Fagerstone. 2011. Long-term fertility control in female cats with GonaCon™, a GnRH immunocontraceptive. Theriogenology 76:1517-1525.

Liu, I.K.M., M. Bernoco, and M. Feldman. 1989. Contraception in mares heteroimmunized with pig zonae pellucidae. Journal of Reproduction and Fertility, 85:19-29.

Madosky, J.M., Rubenstein, D.I., Howard, J.J. and Stuska, S., 2010. The effects of immunocontraception on harem fidelity in a feral horse (Equus caballus) population. Applied Animal Behaviour Science, 128:50-56.

Miller, L.A., J.P. Gionfriddo, K.A. Fagerstone, J.C. Rhyan, and G.J. Killian. 2008. The Single- Shot GnRH Immunocontraceptive Vaccine (GonaCon™) in White-Tailed Deer: Comparisonof Several GnRH Preparations. American Journal of Reproductive Immunology 60:214-223.

Miller, L.A., K.A. Fagerstone, and D.C. Eckery. 2013. Twenty years of immunocontraceptive research: lessons learned. Journal of Zoo and Wildlife Medicine 44:S84-S96.

Mills, L.S. and F.W. Allendorf. 1996. The one-migrant-per-generation rule in conservation and management. Conservation Biology 10:1509-1518.

National Park Service (NPS). 2008. Environmental Assessment of Alternatives for Managing the Feral Horses of Assateague Island National Seashore. NPS Assateague Island National Seashore.

National Research Council of the National Academies of Sciences (NAS). 2013. Using science to improve the BLM wild horse and burro program: a way forward. National Academies Press. Washington, DC.

Nettles, V. F. 1997. Potential consequences and problems with wildlife contraceptives. Reproduction, Fertility and Development 9, 137–143.

Nolan, M.B., H.J. Bertschinger, and M.L. Schulman. 2018a. Antibody response and safety of anovel recombinant Zona Pellucida vaccine formulation in mares. Journal of Equine Veterinary Science 66:97.

Nolan, M.B., H.J. Bertschinger, M. Crampton, and M.L. Schulman. 2018b. Serum anti-Müllerian hormone following Zona Pellucida immunocontraceptive vaccination of mares. Journal of Equine Veterinary Science 66:105

Nolan, M.B., H.J. Bertschinger, R.Roth, M. Crampton, I.S. Martins, G.T. Fosgate, T.A. Stout, and M.L. Schulman. 2018c. Ovarian function following immunocontraceptive vaccination of mares using native porcine and recombinant zona pellucida vaccines formulated with a non-Fre’nd's adjuvant and anti-GnRH vaccines. Theriogenology 120:111-116.

Nuñez, C.M.V., J.S. Adelman, C. Mason, and D.I. Rubenstein. 2009. Immunocontraception decreases group fidelity in a feral horse population during the non-breeding season. Applied Animal Behaviour Science 117:74-83.

Nuñez, C.M., J.S. Adelman, and D.I. Rubenstein. 2010. Immunocontraception in wild horses (Equus caballus) extends reproductive cycling beyond the normal breeding season. PLoSone, 5(10), p.e13635.

Nuñez, C.M.V, J.S. Adelman, J. Smith, L.R. Gesquiere, and D.I. Rubenstein. 2014. Linking social environment and stress physiology in feral mares (Equus caballus): group transfers elevate fecal cortisol levels. General and Comparative Endocrinology. 196:26-33.

Nuñez, C.M., J.S. Adelman, H.A. Carr, C.M. Alvarez, and D.I. Rubenstein. 2017. Lingeringeffects of contraception management on feral mare (Equus caballus) fertility and socialbehavior. Conservation Physiology 5(1): cox018; doi:10.1093/conphys/cox018.

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

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

Powell, D.M. and S.L. Monfort. 2001. Assessment: effects of porcine zona pellucida immunocontraception on estrous cyclicity in feral horses. Journal of Applied Animal Welfare Science 4:271-284.

Powers, J.G., D.L. Baker, T.L. Davis, M.M. Conner, A.H. Lothridge, and T.M. Nett. 2011. Effects of gonadotropin-releasing hormone immunization on reproductive function and behavior in captive female Rocky Mountain elk (Cervus elaph36elsononi). Biology of Reproduction 85:1152-1160.

Powers, J.G., D.L. Baker, M.G. Ackerman, J.E. Bruemmer, T.R. Spraker, M.M. Conner, and T.M.Nett. 2012. Passive transfer of maternal GnRH antibodies does not affect reproductive development in elk (Cervus elaphus nelson) calves. Theriogenology 78:830-841.

Powers, J.G., D.L. Baker, R.J. Monello, T.J. Spraker, T.M. Nett, J.P. Gionfriddo, and M.A. Wild. 2013. Effects of gonadotropin-releasing hormone immunization on reproductive functionand behavior in captive female Rocky Mountain elk (Cervus elaph36elsononi). Journal of Zoo and Wildlife Medicine meeting abstracts S147.

Ransom, J.I. and B.S. Cade. 2009. Quantifying equid behavior: A research ethogram for free-roaming feral horses. U.S. Geological Survey Techniques and Methods Report 2-A9.

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

Ransom, J.I., J.E. Roelle, B.S. Cade, L. Coates-Markle, and A.J. Kane. 2011. Foaling rates in feral horses treated with the immunocontraceptive porcine zona pellucida. Wildlife Society Bulletin 35:343-352.

Ransom, J.I., N.T. Hobbs, and J. Bruemmer. 2013. Contraception can lead to trophic asynchrony between birth pulse and resources. PLoS one, 8(1), p.e54972.

Ransom, J.I., J.G. Powers, N.T. Hobbs, and D.L. Baker. 2014a. Ecological feedbacks can reduce population-level efficacy of wildlife fertility control. Journal of Applied Ecology 51:259-269.

Ransom, J.I., J.G. Powers, H.M. Garbe, M.W. Oehler, T.M. Nett, and D.L. Baker. 2014b.

Behavior of feral horses in response to culling and GnRH immunocontraception. Applied Animal Behaviour Science 157: 81-92.

Roelle, J.E., and J.I. Ransom. 2009. Injection-site reactions in wild horses (Equus caballus) receiving an immunocontraceptive vaccine: U.S. Geological Survey Scientific InvestigationsReport 2009–5038.

Roelle, J.E., F.J. Singer, L.C. Zeigenfuss, J.I. Ransom, F.L. Coates-Markle, and K.A. Schoenecker. 2010. Demography of the Pryor Mountain Wild Horses, 1993-2007. U.S. Geological Survey Scientific Investigations Report 2010–5125.

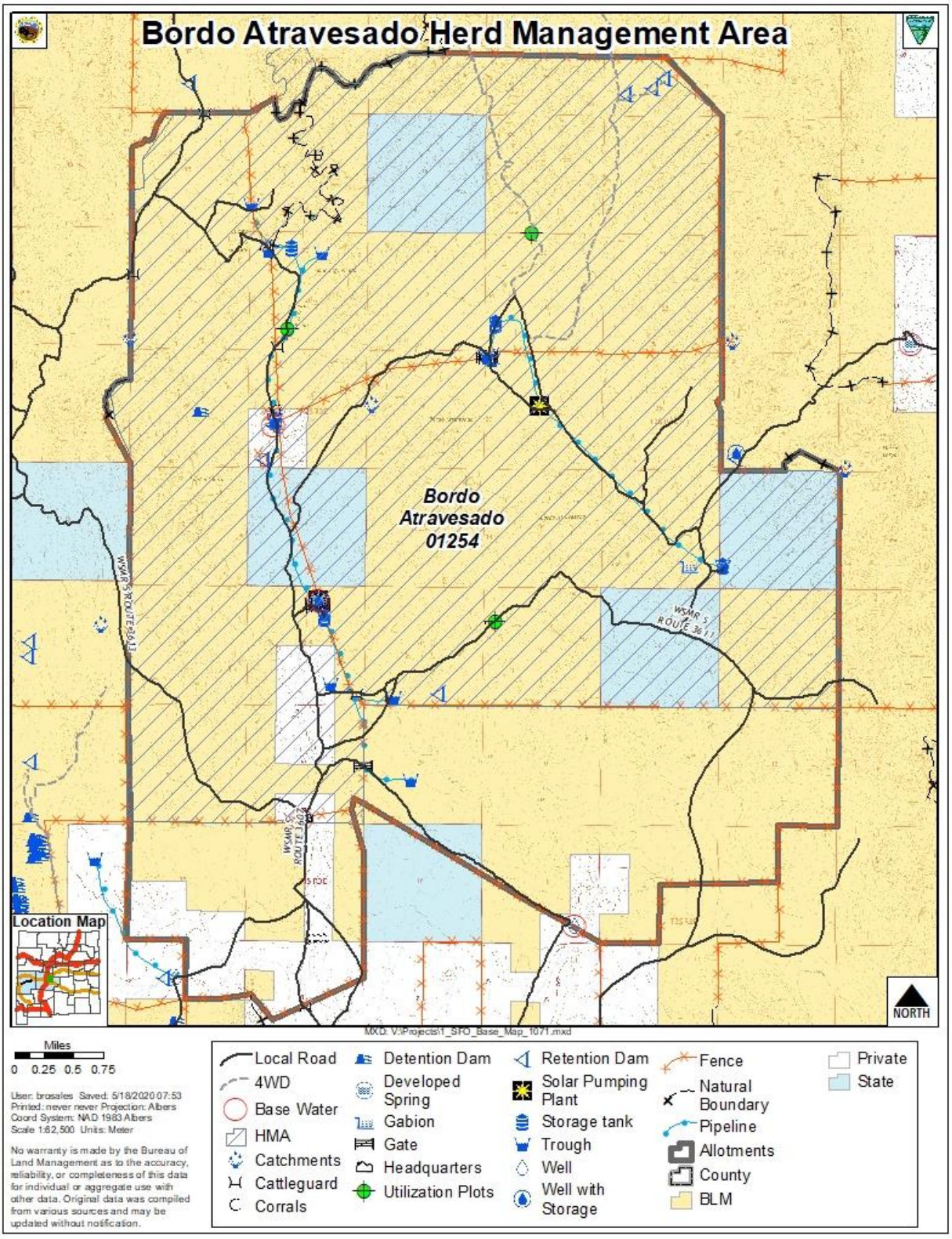
Roelle, J.E. and S.J. Oyler-McCance. 2015. Potential demographic and genetic effects of a sterilant applied to wild horse mares. US Geological Survey Open-file Report 2015-1045.
Roelle, J.E., S.S. Germaine, A.J. Kane, and B.S. Cade. 2017. Efficacy of SpayVac ® as a contraceptive in feral horses. Wildlife Society Bulletin 41:107-115.
Rubenstein, D.I. 1981. Behavioural ecology of island feral horses. Equine Veterinary Journal 13:27-34.
Rutberg, A., K. Grams, J.W. Turner, and H. Hopkins. 2017. Contraceptive efficacy of priming and boosting does of controlled-release PZP in wild horses. Wildlife Research: http://dx.doi.org/10.1071/WR16123
Sacco, A.G., M.G. Subramanian, and E.C. Yurewicz. 1981. Passage of zona antibodies via placenta and milk following active immunization of female mice with porcine zonae pellucidae. Journal of Reproductive Immunology 3:313-322.
Sarker, N., M. Tsudzuki, M. Nishibori, and Y. Yamamoto. 1999. Direct and correlated responseto divergent selection for serum immunoglobulin M and G levels in chickens. Poultry Science 78:1-7.
Schaut, R.G., M.T. Brewer, J.M. Hostetter, K. Mendoza, J.E. Vela-Ramirez, S.M. Kelly, J.K. Jackman, G. D'll'Anna, J.M. Howard, B. Narasimhan, and W. Zhou. 2018. A single dose polyanhydride-based vaccine platform promotes and maintains anti-GnRH antibody titers. Vaccine 36:1016-1023.
Schulman, M.L., A.E. Botha, S.B. Muenscher, C.H. Annandale, A.J. Guthrie, and H.J. Bertschinger. 2013. Reversibility of the effects of GnRH-vaccination used to suppress reproductive function in mares. Equine Veterinary Journal 45:111-113.
Science and Conservation Center (SCC). 2015. Materials Safety Data Sheet, ZonaStat-H.Billings, Montana.
Shumake, S.A. and G. Killian. 1997. White-tailed deer activity, contraception, and estrous cycling. Great Plains Wildlife Damage Control Workshop Proceedings, Paper 376.
Stout, T.A.E., J.A. Turkstra, R.H. Meloen, and B. Colenbrander. 2003. The efficacy of GnRH vaccines in controlling reproductive function in horses. Abstract of presentation from symposiu", "Managing African elephants: act or let die? Utrecht University, Utrecht, Netherlands.
Turner, J.W., I.K.M. Liu, and J.F. Kirkpatrick. 1996. Remotely delivered immunocontraceptionin free-roaming feral burros (Equus asinus). Journal of Reproduction and Fertility 107:31-35.
Turner, J.W., I.K. Liu, A.T. Rutberg, and J.F. Kirkpatrick. 1997. Immunocontraception limits foal production in free-roaming feral horses in Nevada. Journal of Wildlife Management 61:873-880.
Turner, J.W., I.K. Liu, D.R. Flanagan, K.S. Bynum, and A.T. Rutberg. 2002. Porcine zona pellucida (PZP) immunocontraception of wild horses (Equus caballus) in Nevada: a 10 yearstudy. Reproduction Supplement 60:177-186.
Turner, J.W., and J.F. Kirkpatrick. 2002. Effects of immunocontraception on population, longevity and body condition in wild mares (Equus caballus). Reproduction (Cambridge,England) Supplement, 60, pp.187-195.
Turner, J.W., I.K. Liu, D.R. Flanagan, A.T. Rutberg, and J.F. Kirkpatrick. 2007. Immunocontraception in wild horses: one inoculation provides two years of infertility. Journal of Wildlife Management 71:662-667.
Turner, J. W, A.T. Rutberg, R.E. Naugle, M.A. Kaur, D.R.Flanagan, H.J. Bertschinger, and I.K.M.Liu. 2008. Controlled-release components of PZP contraceptive vaccine extend duration of infertility. Wildlife Research 35:555-562.
US Fish and Wildlife Service (USFWS). 2015. Endangered and Threatened Wildlife and Plants;90-day findings on 31 petitions. Federal Register 80 (126):37568-37579.
Wang-Cahill, F., J. Warren, T. Hall, J' O'Hare, A. Lemay, E. Ruell, and R. Wimberly. In press. Use of GonaCon in wildlife management. Chapter 24 in USDA-APHIS, Human health andecological risk assessment for the use of wildlife damage management methods by APHIS-Wildlife

Services. USDA APHIS, Fort Collins, Colorado.
Wright, S. 1931. Evolution in Mendelian populations. Genetics 16:97-159.
Yao, Z., W. Si, W. Tian, J. Ye, R. Zhu, X. Li, S. Ki, Q. Zheng, Y. Liu, and F. Fang. 2018. Effect ofactive immunization using a novel GnRH vaccine on reproductive function in rats. Theriogenology 111:1-8. https://doi.org/10.1016/j.theriogenology.2018.01.013
Zoo Montana. 2000. Wildlife Fertility Control: Fact and Fancy. Zoo Montana Science and Conservation Biology Program, Billings, Montana.

Acronyms

BLM-Bureau of Land Management
BIA- Bureau of Indian Affairs
CFR-Code of Federal Regulations
DR-Decision Record
EA-Environmental Assessment
EIS-Environmental Impact Statement
FLPMA-Federal Land Policy and Management Act
FONSI-Finding of No Significant Impact
HA – Herd Area
HMA – Herd Management Area
ID-Interdisciplinary
IM-Instructional Memorandum
NEPA-National Environmental Policy Act
RFS-Reasonably Foreseeable Future Action
RMP-Resource Management Plan

APPENDIX A: HMA MAP



APPENDIX B. Comprehensive Animal Welfare Program for Wild Horse and Burro Gathers SOPs

In 2021 (IM2021-002), BLM initiated a comprehensive animal welfare program (CAWP) which updated WH&B gather SOPs to formalize the standards, training and monitoring for conducting safe, efficient and successful WH&B gather operations while ensuring humane care and handling of animals gathered. These standards include requirements for trap and temporary holding facility design; capture and handling; transportation; and appropriate care after capture. The standards have been incorporated into helicopter gather contracts as specifications for performance. It includes a requirement that all Incident Commanders (IC), Lead Contracting Officer Representatives (LCOR), Contracting Officer Representatives (COR), Project Inspectors (PI), and contractors must complete a mandatory training course covering all aspects of the CAWP prior to gathers. The goal is to ensure that the responsibility for humane care and treatment of WH&Bs remains a high priority for the BLM and its contractors at all times. The BLM's objective is to use the best available science, husbandry and handling practices applicable for WH&Bs and to make improvements whenever possible, while also meeting our overall gather goals and objectives in accordance with current BLM policy, SOPs and contract requirements.

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

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

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

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

1. Bait Trapping. This gather method involves utilizing bait (e.g., water or feed) to lure wild horses into a temporary trap.

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

FEEDING AND WATERING

a. Adult WH&Bs held in traps or temporary holding pens for longer than 12 hours must be fed every morning and evening and provided with drinking water at all times other than when animals are being sorted or worked.

b. Dependent foals must be reunited with their mares/jennies at the temporary holding facility within four hours of capture unless the LCOR/COR/PI authorizes a longer time or foals are old enough to be weaned. If a nursing foal is held in temporary holding pens for longer than 4 hours without their dams, it must be provided with water and good quality weed seed free hay.

c. Water must be provided at a minimum rate of 10 gallons per 1,000 pound animal per day, adjusted accordingly for larger or smaller horses, burros and foals, and environmental conditions, with each trough placed in a separate location of the pen (i.e. troughs at opposite ends of the pen) with a minimum of one trough per 30 horses. Water must be refilled at least every morning and evening when necessary.

d. Good quality weed seed free hay must be fed at a minimum rate of 20 pounds per 1,000 pound adult animal per day, adjusted accordingly for larger or smaller horses, burros and foals.

1. Hay must not contain poisonous weeds or toxic substances.
2. Hay placement must allow all WH&B's to eat simultaneously.

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

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

TEMPORARY HOLDING FACILITY
a. All WH&B's in confinement must be observed at least twice daily during feeding time to identify sick or injured WH&Bs and ensure adequate food and water.

b. Non-ambulatory WH&B's must be located in a pen separate from the general population and must be examined by the LCOR/COR/PI and/or on-call or on-site veterinarian no more than 4 hours after recumbency (lying down) is observed. Unless otherwise directed by a veterinarian, hay and water must be accessible to an animal within six hours after recumbency.

c. Alternate pens must be made available for the following:

1. WH&Bs that are weak or debilitated
2. Mares/jennies with dependent foals
3. Aggressive WH&B's that could cause serious injury to other animals.

d. WH&B's in pens at the temporary holding facility shall be maintained at a proper stocking density such that when at rest all WH&B's occupy no more than half the pen area.

e. It is the responsibility of the Contractor to provide security to prevent loss, injury or death of captured animals until delivery to final destination.

f. It is the responsibility of the Contractor to provide for the safety of the animals and personnel working at the trap locations and temporary holding corrals in consultation with the LCOR/COR/PI. This responsibility will not be used to exclude or limit public and media observation as long as current BLM policies are followed.

g. The contractor will ensure that non-essential personnel and equipment are located as to minimize disturbance of WH&Bs. Trash, debris, and reflective or noisy objects shall be eliminated from the trap site and temporary holding facility.

h. The Contractor shall restrain sick or injured animals if treatment is necessary in consultation with the LCOR/COR/PI and/or onsite veterinarian. The LCOR/COR/PI and/or onsite veterinarian will determine if injured animals must be euthanized and provide for the euthanasia of such animals. The Contractor may be required to humanely euthanize animals in the field and to dispose of the carcasses as directed by the LCOR/COR/PI, at no additional cost to the Government.

i. Once the animal has been determined by the LCOR/COR/PI to be removed from the HMA/HA, animals shall be transported to final destination from temporary holding facilities within 48 hours after capture unless prior approval is granted by the LCOR/COR/PI. Animals to be released back into the HMA following gather operations will be held for a specified length of time as stated in the Task Order/SOW. The Contractor shall schedule shipments of animals to arrive at final destination between 7:00 a.m. and 4:00 p.m. unless prior approval has been obtained by the LCOR. No shipments shall be scheduled to arrive at final destination on Sunday and Federal holidays, unless prior approval has been obtained by the LCOR. Animals shall not be allowed to remain standing on gooseneck or semi-trailers while not in transport for a combined period of greater than three (3) hours. Total planned transportation time from the temporary holding to the BLM facility will not exceed 10 hours. Animals that are to be released back into the capture area may need to be transported back to the original trap site per direction of the LCOR.

CAPTURE METHODS THAT MAY BE USED IN THE PERFORMANCE OF A GATHER

HANDLING

Willful Acts of Abuse
The following are prohibite
a. Hitting, kicking, striking, or beating any WH&B in an abusive manner.

b. Dragging a recumbent WH&B across the ground without a sled, slide board or slip sheet. Ropes used for moving the recumbent animal must be attached to the sled, slide board or slip sheet unless being loaded as specified in Section C 9.2.h

c. Deliberate driving of WH&Bs into other animals, closed gates, panels, or other equipment.

d. Deliberate slamming of gates and doors on WH&Bs.

e. Excessive noise (e.g., constant yelling) or sudden activity causing WH&Bs to become unnecessarily flighty, disturbed or agitated.

General Handling
a. All sorting, loading or unloading of WH&Bs during gathers must be performed during daylight hours except when unforeseen circumstances develop and the LCOR/COR/PI approves the use of supplemental light.

b. WH&Bs should be handled to enter runways or chutes in a forward direction.

c. WH&Bs should not remain in single-file alleyways, runways, or chutes longer than 30 minutes.

d. With the exception of helicopters, equipment should be operated in a manner to minimize flighty behavior and injury to WH&Bs.

Handling Aids
a. Handling aids such as flags and shaker paddles are the primary tools for driving and moving WH&Bs during handling and transport procedures. Contact of the flag or paddle end with a WH&B is allowed.

Ropes looped around the hindquarters may be used from horseback or on foot to assist in moving an animal forward or during loading.

b. Routine use of electric prods as a driving aid or handling tool is prohibited. Electric prods may be used in limited circumstances only if the following guidelines are followed:

1. Electric prods must only be a commercially available make and model that uses DC battery power and batteries should be fully charged at all times.
2. The electric prod device must never be disguised or concealed.
3. Electric prods must only be used after three attempts using other handling aids (flag, shaker paddle, voice or body position) have been tried unsuccessfully to move the WH&Bs.
4. Electric prods must only be picked up when intended to deliver a stimulus; these devices must not be constantly carried by the handlers.
5. Space in front of an animal must be available to move the WH&B forward prior to application of the electric prod. 000230 Antelope and Triple B Complexes Gather Plan EA
Chapter 8. Appendix III 9
6. Electric prods must never be applied to the face, genitals, anus, or underside of the tail of a WH&B.
7. Electric prods must not be applied to any one WH&B more than three times during a procedure (e.g., sorting, loading) except in extreme cases with approval of the LCOR/COR/PI. Each exception must be approved at the time by the LCOR/COR/PI.
8. Any electric prod use that may be necessary must be documented daily by the LCOR/COR/PI including time of day, circumstances, handler, location (trap site or temporary holding facility), and any injuries (to WH&B or human)

MOTORIZED EQUIPMENT

Loading and Unloading Areas

a. Facilities in areas for loading and unloading WH&B's at the trap site or temporary holding facility must be maintained in a safe and proper working condition, including gates that swing freely and latch or tie easily.

b. The side panels of the loading chute must be a minimum of 6 feet high and fully covered with materials such as plywood or metal without holes that may cause injury.

c. There must be no holes, gaps or openings, protruding surfaces, or sharp edges present in fence panels or other structures that may cause escape or possible injury.

d. All gates and doors must open and close properly and latch securely.

e. Loading and unloading ramps must have a non-slip surface and be maintained in a safe and proper working condition to prevent slips and falls**.** Examples of non-slip flooring would include, but not be limited to, rubber mats, sand, shavings, and steel reinforcement rods built into ramp. There must be no holes in the flooring or items that can cause an animal to trip.

f. Trailers must be properly aligned with loading and unloading chutes and panels such that no gaps exist between the chute/panel and floor or sides of the trailer creating a situation where a WH&B could injure itself.

g. Stock trailers shall be positioned for loading or unloading such that there is no more than 12" clearance between the ground and floor of the trailer for burros and 18" for horses. . If animals refuse to load, it may be necessary to dig a tire track hole where the trailer level is closer to ground level.

TRANSPORTATION

A. General

1. All sorting, loading, or unloading of WH&Bs during gathers must be performed during daylight hours except when unforeseen circumstances develop and the LCOR/COR/PI approves the use of supplemental light.

2. WH&Bs identified for removal should be shipped from the temporary holding facility to a BLM facility within 48 hours.

3. Shipping delays for animals that are being held for release to range or potential on-site adoption must be approved by the LCOR/COR/PI.

4. Shipping should occur in the following order of priority; 1) debilitated animals, 2) pairs, 3) weanlings, 4) dry mares and 5) studs.

5. Total planned transport time to the BLM preparation facility from the trap site or temporary holding facility must not exceed 10 hours.

6. WH&Bs should not wait in stock trailers and/or semi-trailers at a standstill for more than a combined period of three hours during the entire journey.

B. Vehicles

1. All motorized equipment employed in the transportation of captured animals shall be in compliance with appropriate State and Federal laws and regulations applicable to the humane transportation of animals. The Contractor shall provide the CO annually, with a current safety inspection (less than one year old) for all motorized equipment and tractor-trailers used to transport animals to final destination.

2. Only tractor-trailers or stock trailers with a covered top or overhead bars shall be allowed for transporting animals from trap site(s) to temporary holding facilities, and from temporary holding facilities to final destination(s). Sides or stock racks of all trailers used for transporting animals shall be a minimum height of 6 feet 6 inches from the floor. Single deck tractor-trailers 40 feet or longer shall have two (2) partition gates providing three (3) compartments within the trailer to separate animals. Tractor-trailers less than 40 feet shall have at least one partition gate providing two (2) compartments within the trailer to separate the animals. Compartments in all tractor-trailers shall be of equal size plus or minus 10 percent. Each partition shall be a minimum of 6 feet high and shall have a minimum 5 foot wide swinging gate. The use of double deck tractor-trailers is prohibited. Only straight deck trailers and stock trailers are to be used for transporting WH&B's.

3. WH&B's must have adequate headroom during loading and unloading and must be able to maintain a normal posture with all four feet on the floor during transport without contacting the roof or overhead bars.

4. The width and height of all gates and doors must allow WH&B's to move through freely.

5. All gates and doors must open and close easily and be able to be secured in a closed position.

6. The rear door(s) of stock trailers must be capable of opening the full width of the trailer.

7. Loading and unloading ramps must have a non-slip surface and be maintained in proper working condition to prevent slips and falls.

8. All partitions and panels inside of trailers must be free of sharp edges or holes that could cause injury to WH&B's.

9. The inner lining of all trailers must be strong enough to withstand failure by kicking that would lead to injuries.

10. Partition gates in transport vehicles shall be used to distribute the load into compartments during travel.

11. Surfaces and floors of trailers must be cleaned of dirt, manure and other organic matter prior to the beginning of a gather.

12. Surfaces and floors of trailers shall have non-slip surface, use of shavings, dirt, and floor mates.

C. Care of WH&B's during Transport Procedures

1. WH&B's that are loaded and transported from the temporary holding facility to the BLM preparation facility must be fit to endure travel per direction of LCOR/COR/PI following consultation with on-site/on-call veterinarian.

2. WH&B's that are non-ambulatory, blind in both eyes, or severely injured must not be loaded and shipped unless it is to receive immediate veterinary care or euthanasia.

3. WH&B's that are weak or debilitated must not be transported without approval of the LCOR/COR/PI in consultation with the on-site veterinarian. Appropriate actions for their care during transport must be taken according to direction of the LCOR/COR/PI.

4. WH&B's shall be sorted prior to transport to ensure compatibility and minimize aggressive behavior that may cause injury.

5. Trailers must be loaded using the minimum space allowance in all compartments as follows:

a. For a 6.8 foot wide; 24 foot long stock trailer 12 to 14 adult horses;
b. For a 6.8 foot wide; 24 foot long stock trailer 18 to 21 adult burros
c. For a 6.8 foot wide; 20 foot long stock trailer 10 to 12 adult horses can be loaded
d. For a 6.8 foot wide; 20 foot long stock trailer 15 to 18 adult burros

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

6. Considering the condition of the animals, prevailing weather, travel distance and other factors or if animals are going down on trailers or arriving at their destination down or with injuries or a condition suggesting they may have been down, additional space or footing provisions may be necessary and will be required if directed by the LCOR/COR.

7. The LCOR/COR/PI, in consultation with the receiving Facility Manager, must document any WH&B that is recumbent or dead upon arrival at the destination. Non-ambulatory or recumbent WH&B's must be evaluated on the trailer and either euthanized or removed from the trailers using a sled, slide board or slip sheet.

8. Saddle horses must not be transported in the same compartment with WH&B's.

EUTHANASIA or DEATH

Euthanasia Procedure during Gather Operations

1. An authorized, properly trained, and experienced person as well as a firearm appropriate for the circumstances must be available at all times during gather operations. When the travel time between the trap site and temporary holding facility exceeds one hour or if radio or cellular communication is not reliable, provisions for euthanasia must be in place at both the trap site and temporary holding facility during the gather operation.

2. Euthanasia must be performed according to American Veterinary Medical Association euthanasia guidelines (2013) using methods of gunshot or injection of an approved euthanasia agent.

3. The decision to euthanize and method of euthanasia must be directed by the LCOR/COR/PI who must be on site and may consult with the on-site/on-call veterinarian. In event and rare circumstance that the LCOR/COR/PI is not available, the contractor if properly trained may euthanize an animal as an act of mercy.

4. All carcasses will be disposed of in accordance with state and local laws and as directed by the LCORCOR/PI.

5. Carcasses left on the range should not be placed in washes or riparian areas where future runoff may carry debris into ponds or waterways. Trenches or holes for buried animals should be dug so the bottom of the hole is at least 6 feet above the water table and 4-6 feet of level earth covers the top of the carcass with additional dirt mounded on top where possible.

COMMUNICATIONS

a. The Contractor shall have the means to communicate with the LCOR/COR/PI and all contractor personnel engaged in the capture of wild horses and burros utilizing a VHF/FM Transceiver or VHF/FM portable Two-Way radio.

b. The Contractor shall obtain the necessary FCC licenses for the radio system.

SAFETY AND SECURITY

a. All accidents involving animals or people that occur during the performance of any task order shall be immediately reported to the LCOR/COR/PI.

b. It is the responsibility of the Contractor to provide security to prevent unauthorized release, injury or death of captured animals until delivery to final destination.

c. The contractor must comply with all applicable federal, state and local regulations.

d. Fueling operations shall not take place within 1,000 feet of animals or personnel and equipment other than the refueling truck and equipment.

e. Children under the age of 12 shall not be allowed within the gather's working areas which include near the chute when working animals at the temporary holding facility, or near the pens at the trap site when working and loading of animals. Children under the age of 12 in the non-working area must be accompanied by an adult at either location at all times.

BLM ROLES AND RESPONSIBILITIES

a. Veterinarian
1. On-site veterinary support must be provided for all helicopter gathers.

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

b. Transportation
1. The LCOR/COR/PI shall consider the condition and size of the animals, weather conditions, distance to be transported to the final destination or release, recommendations from the contractor and on-site veterinarian and other factors when planning for the movement of captured animals. The LCOR/COR/PI shall provide for any brand inspection services required for the movement of captured animals to BLM prep facilities. If animals are to be transported over state lines the LCOR will be responsible for obtaining a waiver from the receiving State Veterinarian.

2. If the LCOR/COR/PI determines that conditions are such that the animals could be endangered during transportation, the Contractor will be instructed to adjust speed or delay transportation until conditions improve.

GOVERNMENT FURNISHED EQUIPMENT/SUPPLIES/MATERIALS
a. The government will provide:

1. A portable restraining chute for each contractor to be used for the purpose of restraining animals to determine the age of specific individuals or other similar procedures. The contractor will be responsible for the maintenance of the portable restraining chute during the gather season.
2. All inoculate syringes, freezemarking equipment, and all related equipment for fertility control treatments.
3. A boat to transport burros as appropriate.
4. Sleds, slide boards, or slip sheets for loading of recumbent animals.

b. The Contractor shall be responsible for the security of all Government Furnished Property.

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

Water and Bait Trapping Standard Operating Procedures
The work consists of the capture, handling, care, feeding, daily rate and transportation of wild horses and/or burros from the States of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah and Wyoming. The method of capture will be with the use of bait and/or water traps in accordance with the standards identified in the Comprehensive Animal Welfare Program (CAWP) for Wild horse and Burro Gathers, Bureau of Land Management (BLM) Instruction Memorandum 2021-002 (Attachment 1). Items listed in the sections of the Statement of Work (SOW) either are not covered or deviate from the CAWP, the SOW takes precedence over the CAWP when there is conflicting information. Extended care, handling and animal restraint for purposes of population growth suppression treatments may be required for some trapping operations. The contractor shall furnish all labor, supplies,

transportation and equipment necessary to accomplish the individual task order requirements with the exception of a Government provided restraint fly chute, as needed for population growth suppression. The work shall be accomplished in a safe and humane manner and be in accordance with the provisions of 43 CFR Part 4700, the CAWP, the specifications and provisions included in this SOW, and any subsequent SOW documents issued with individual task orders. The primary concern of the contractor shall be the safety of all personnel involved and the humane capture and handling of all wild horses and burros. It is the responsibility of the contractor to provide appropriate safety and security measures to prevent loss, injury or death of captured wild horses and burros.

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

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

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

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

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

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

Facility design to include traps, wings, alleys, handling pens, finger gates, and temporary holding facilities, etc. shall be constructed, maintained and operated to handle the wild horses and burros in a safe and humane manner in accordance with the standards identified in the Comprehensive Animal Welfare Program (CAWP) for Wild Horse and Burro Gathers, Bureau of Land Management (BLM) Instruction Memorandum 2021-002 (Attachment 1).

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

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

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

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

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

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

Bait Trapping, Animal Care, and Handling

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

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

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

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

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

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

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

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

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

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

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

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

Wild Horse and Burro Care and Biosecurity
The contractor shall restrain sick or injured wild horses and burros if treatment is necessary in consultation with the COR/PI and/or veterinarian.

Any saddle or pilot horses used by the contractor will be vaccinated within 12 months of use (EWT, West Nile, Flu/rhino, strangles).

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

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

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

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

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

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

Euthanasia or Death
The COR/PI will determine if a wild horse or burro must be euthanized and will/may direct the contractor to destroy the animal in accordance with the BLM Animal Health, Maintenance, Evaluation, and Response Instruction Memorandum, 2015-070 (Attachment 2). Any contractor personnel performing this task shall be trained as described in this Memorandum.

Pursuant to the IM 2015-070 the contractor may be directed by the Authorized Officer and/or COR to humanely euthanize wild horses and burros in the field and to dispose of the carcasses in accordance with state and local laws.

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

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

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

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

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

The contractor will provide daily gather activity reports to the COR/PI if they are not present.

Public and Media
Due to increased public interest in the Wild Horse and Burro Gathers, any media or visitation requests received by the contractor shall be forwarded to the COR immediately. Only the COR or CO can approve these requests.

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

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

1. All motorized equipment employed in the transportation of captured animals shall be in compliance with appropriate State and Federal laws and regulations applicable to the humane transportation of animals. The Contractor shall provide the COR/PI with a current safety inspection (less than one year old) for all motorized equipment and tractor-trailers used to transport animals to final destination.

2. All motorized equipment, tractor-trailers, and stock trailers shall be in good repair, of adequate rated capacity, and operated so as to ensure that captured animals are transported without undue risk or injury.

3. Only tractor-trailers or stock trailers with a covered top shall be allowed for transporting animals from gather site(s) to temporary holding facilities and from temporary holding facilities to final destination(s). Sides or stock racks of all trailers used for transporting animals shall be a minimum height of 6 feet 6 inches from the floor. Single deck tractor-trailers 40 feet or longer shall have two (2) partition gates providing three (3) compartments within the trailer to separate animals. Tractor-trailers less than 40 feet

shall have at least one partition gate providing two (2) compartments within the trailer to separate the animals. Compartments in all tractor-trailers shall be of equal size plus or minus 10 percent. Each partition shall be a minimum of 6 feet high and shall have a minimum 5 foot wide swinging gate. The use of double deck tractor-trailers is unacceptable and shall not be allowed.

4. All tractor-trailers used to transport animals to final destination(s) shall be equipped with at least one (1) door at the rear end of the trailer which is capable of sliding either horizontally or vertically. The rear door(s) of tractor- trailers and stock trailers must be capable of opening the full width of the trailer. Panels facing the inside of all trailers must be free of sharp edges or holes that could cause injury to the animals. The material facing the inside of all trailers must be strong enough so that the animals cannot push their hooves through the side. Final approval of tractor-trailers and stock trailers used to transport animals shall be held by the COR/PI.

5. Floors of tractor-trailers, stock trailers and loading chutes shall be covered and maintained with wood shavings to prevent the animals from slipping.

6. Animals to be loaded and transported in any trailer shall be as directed by the COR/PI and may include limitations on numbers according to age, size, sex, temperament and animal condition. The following minimum square feet per animal shall be allowed in all trailers:

a. 11 square feet per adult horse (1.4 linear foot in an 8 foot wide trailer);
b. 8 square feet per adult burro (1.0 linear foot in an 8 foot wide trailer);
c. 6 square feet per horse foal (.75 linear foot in an 8 foot wide trailer);
d. 4 square feet per burro foal (.50 linear feet in an 8 foot wide trailer).

7. The COR/PI shall consider the condition and size of the animals, weather conditions, distance to be transported, or other factors when planning for the movement of captured animals. The COR/PI shall provide for anybrand and/or inspection services required for the captured animals.

8. If the COR/PI determines that dust conditions are such that the animals could be endangered during transportation, the Contractor will be instructed to adjust speed.

Safety and Communications

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

a. The proper operation, service and maintenance of all contractor furnished property are the responsibility of the Contractor. The BLM reserves the right to remove from service any contractor personnel or contractor furnished equipment which, in the opinion of the contracting officer or COR/PI violate contract rules, are unsafe or otherwise unsatisfactory. In this event, the Contractor will be notified in writing to furnish replacement personnel or equipment within 48 hours of notification. All such replacements must be approved in advance of operation by the Contracting Officer or his/her representative.

b. The Contractor shall obtain the necessary FCC licenses for the radio system

c. All accidents occurring during the performance of any task order shall be immediately reported to the COR/PI.

Public and Media

Due to heightened public interest in wild horse and burro gathers, the BLM/Contractor may expect an increasing number of requests from the public and media to view the operation.

1. Due to this type of operation (luring wild horses and burros to bait) spectators and viewers will be prohibited as it will have impacts on the ability to capture wild horses and burros. Only essential personnel (COR/PI, veterinarian, contractor, contractor employees, etc.) will be allowed at the trap site during operations.

2. Public viewing of the wild horses and burros trapped may be provided at the staging area and/or the BLM preparation facility by appointment.

3. The Contractor agrees that there shall be no release of information to the news media regarding the removal or remedial activities conducted under this contract.

4. All information will be released to the news media by the assigned government public affairs officer.

5. If the public or media interfere in any way with the trapping operation, such that the health and wellbeing of the crew, horses and burros is threatened, the trapping operation will be suspended until the situation is resolved.

COR/PI Responsibilities

a. In emergency situations, the COR/PI will implement procedures to protect animals as rehab is initiated, i.e. rationed feeding and watering at trap and or staging area.

b. The COR/PI will authorize the contractor to euthanize any wild horse or burros as an act of mercy.

c. The COR/PI will ensure wild horses or burros with pre-existing conditions are euthanized in the field according to BLM policy.

d. Prior to setting up a trap or staging area on public land, the BLM and/or Forest Service will conduct all necessary clearances (archaeological, T&E, etc.). All proposed sites must be inspected by a government archaeologist or equivalent. Once archaeological clearance has been obtained, the trap or staging area may be set up. Said clearances shall be arranged for by the COR/PI.

e. The COR/PI will provide the contractor with all pertinent information on the areas and wild horses and burros to be trapped.

f. The COR/PI will be responsible to establish the frequency of communicating with the contractor.

g. The COR/PI shall inspect trap operation prior to Contractor initiating trapping.

h. The Contractor shall make all efforts to allow the COR/PI to observe a minimum of at least 25% of the trapping activity.

i. The COR/PI is responsible to arrange for a brand inspector and/or veterinarian to inspect all wild horses and burros prior to transporting to a BLM preparation facility when legally required.

j. The COR/PI will be responsible for the establishing a holding area for administering PZP, gelding of stallions, holding animals in poor condition until they are ready of shipment, holding for EIA testing, etc.

k. The COR/PI will ensure the trailers are cleaned and disinfected before WH&B's are transported. This will help prevent transmission of disease into our populations at a BLM Preparation Facility.

Responsibility and Lines of Communication

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

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

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

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

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

Resource Protection

Gather sites and holding facilities would be located in previously disturbed areas whenever possible to minimize potential damage to the natural and cultural resources.

Gather sites and temporary holding facilities would not be constructed on wetlands or riparian zones.

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

Gather sites and holding facilities would not be placed in known areas of Native American concern.

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

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

APPENDIX C: Population Modeling in WinEquus

Overview: The WinEquus population modeling program (Jenkins 1996) was used to simulate population size in the Bordo Atravesado HMA, with parameters to represent the management scenarios in the three Alternatives analyzed in the EA (No Action, Removals + Sex Ratio Manipulation, and Removals + Fertility Control Vaccines).

Results Summary Table, for starting population size 150 in 2021 (initial year of simulations is 2022). Median values are shown, as well as average from the 10^{th} and 90^{th} percentile in parentheses. So, the range in curly brackets conveys an uncertainty interval that contains 80% of the 100 simulated population trials that resulted from the input parameters in the model.

	No Action	Removals + Sex Ratio	Removals + Vaccines	Removals + Vaccines + Sex Ratio
Population Size in 2032	558 {466, 629}	81 {75, 86}	94 {88, 101}	69 {58, 76}
Annual Growth Rate	20.5% {17.8, 22.7}	9.8% {6.0, 13.5}	16.2% {12.3, 19.8}	7.6% {2.7 ,10.3}

Interpretation: In almost all simulations, the wild horse herd of Bordo Atravesado HMA did not fall below low AML, and the herd did not stay below low AML for very long in any simulation. It is not expected that any of these alternatives would cause the herd to decline to zero. Both of the Action Alternatives lead to expected herd sizes that are relatively close to AML, compared to the No Action Alternative, and there are many years in the when the simulated herds are within AML, under the Action Alternatives.

These average simulated growth rate for the No Action Alternative is about 20%, which is generally consistent with expectations for wild horse herds (Ransom et al. 2016). Simulations show a lower expected growth rate for the Removals + Sex Ratio Manipulation Alternative than the Removals + Fertility Control Vaccines Alternative, but this may be an artefact of the default values for 'percent effectiveness of fertility control' assumptions. One of the known shortcomings of the WinEquus system is that it cannot model fertility control vaccine effectiveness that becomes higher after booster doses. Therefore, it is reasonable to expect that the annual growth rate could be lower than modeled for the Removals + Vaccines Alternative, if a vaccine is used that has higher efficacy when booster doses are given, such as can be the case for both PZP vaccines and GonaCon vaccine. However, given these results, it is unlikely that use of vaccines and gathers would cause the herd to stay below AML.

I. Model Simulation Assumptions Common to All Alternatives

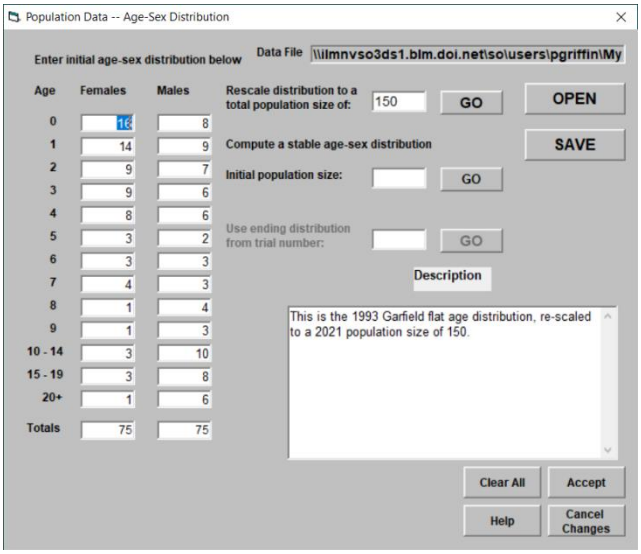
II. The starting population size in 2021 was 150 animals total. By extension, assuming about a 20% annual growth rate one would expect a population size by the end of 2022 of about 180.

AML in Bordo Atravesado HMA is 40-60 wild horses. For scenarios with removals, a gather can take place if herd size is above high AML (60), and removals are down to low AML (40). For modeling, foals are not included in AML.

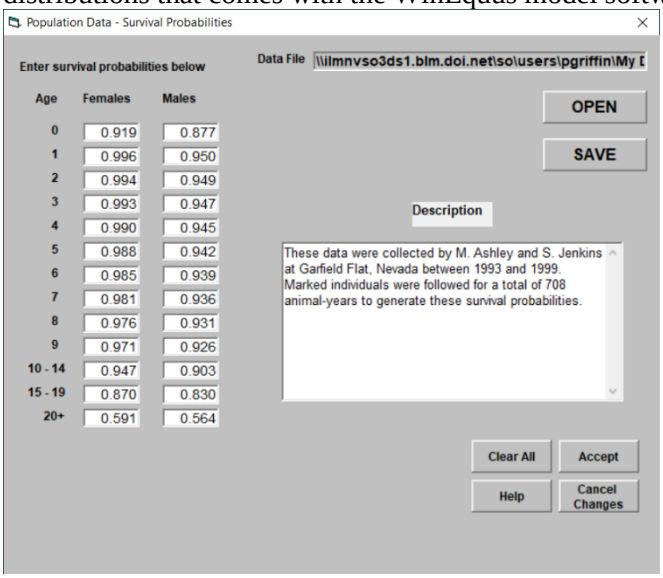
Assumed gather efficiency is 93%, which is based on the previous gather, when 86 were gathered and 6 were missed.

For models with effects of fertility control vaccines, use the default effectiveness for vaccines. That is, 90% for 1 year. WinEquus is not structured to allow for modeling of higher effectiveness after a booster dose.

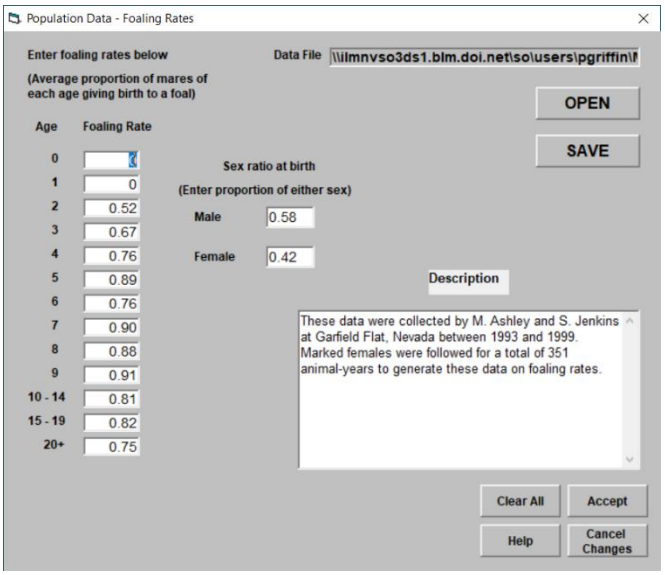
Age distribution: The Garfield Flat 1993 age distribution was used. That is one of the available age distributions that comes with the WinEquus model software. That is for a time period when that herd had not received any fertility control treatments, and the distribution was before any large-scale selective removals. The starting population size was re-scaled to a total of 150.



Survival Rates: Garfield Flats survival rates were used. That is one of the available survival rate distributions that comes with the WinEquus model software.

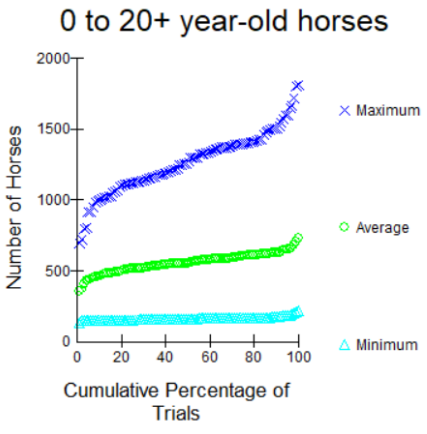


Fertility Rates: Garfield Flats HMA foaling rates were used. That is one of the available foaling rate distributions that comes with the WinEquus model software.



Modeling Duration: 2021 is taken as the initial year, with 150 total horses being the population size in 2021. The population is modeled through 2032. That is 10 years after the expected date of the initial gather, in 2022. The Removals + Fertility Control Vaccines Alternative was also simulated for 20 years, but results for 20 years (median population size after 20 years of 79 horses and 13.6 % annual growth rate on average) were generally consistent with the 11-year simulations and are not shown here in detail. Below, each Alternative is represented by specific model input parameters in WinEquus and simulated 100 times. The summarized outcomes from each Alternative are shown in terms of: a) the overall expected herd size after 11 years; b) a time series graph of what WinEquus has identified as the 'most typical' out of the 100 simulations; c) the number of animals that would be gathered and fertility control treated over those 11 years; and d) the annual growth rates recorded from those 100 simulations.

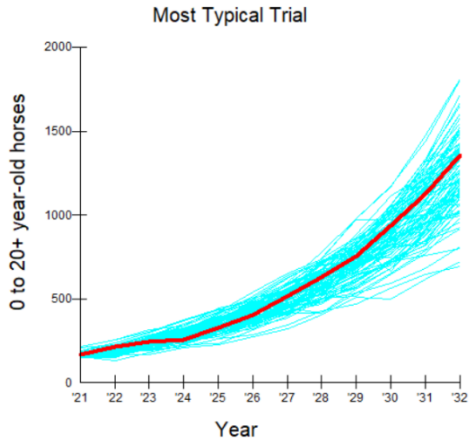
<u>No Action: Summary of Population Size simulations</u>



	Population Sizes in 12 Years*		
	Minimum	Average	Maximum
Lowest Trial	132	355	694
10th Percentile	152	466	1009
25th Percentile	156	517	1128
Median Trial	162	558	1286
75th Percentile	170	607	1402
90th Percentile	176	629	1518
Highest Trial	216	731	1810

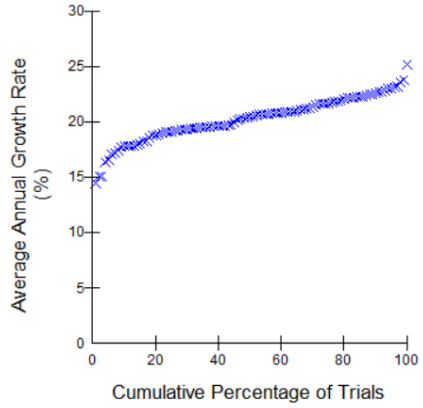
* 0 to 20+ year-old horses

No Action: Most Typical Trajectory



No Action: Gathers {Gathers are not included as model outputs in this scenario}

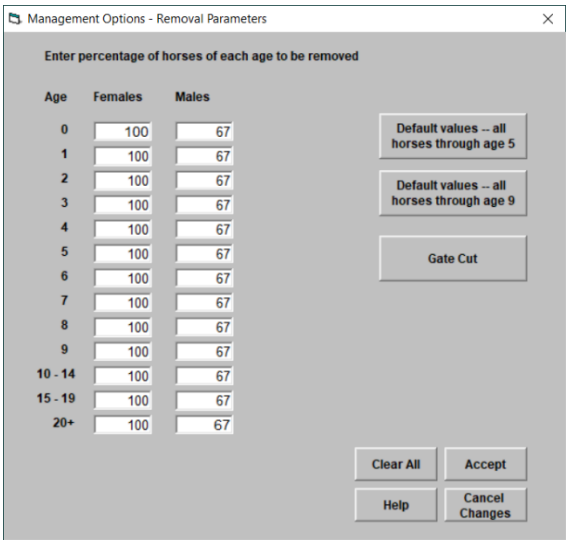
No Action: Growth Rate



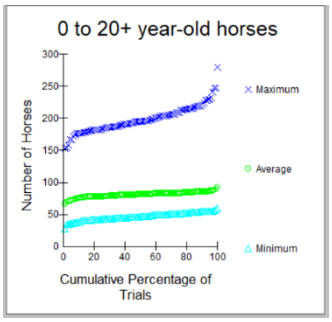
Average Growth Rate in 11 Years	
Lowest Trial	14.5%
10th Percentile	17.8%
25th Percentile	19.2%
Median Trial	20.5%
75th Percentile	21.7%
90th Percentile	22.7%
Highest Trial	25.2%

III. Removals and Sex Ratio Alternative (no Fertility Control Vaccines)

Additional model Input assumptions: Removals can take place any year when the population size exceeds high AML but minimum time period between removals is 3 years. The herd is removed down to low AML. Sex ratio removed is unequal: To achieve the approximate 60% male and 40% female sex ratio, the ratio of animals removed will be 60% female and 40% female (in WinEquus terms, this means that 100% of females are gate-cut removed, but 67% of males captured are removed).



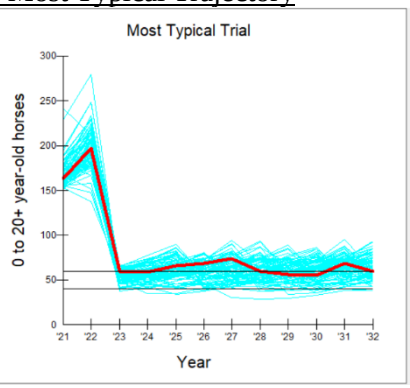
Removals + Sex Ratio: Summary of Population Size Simulations



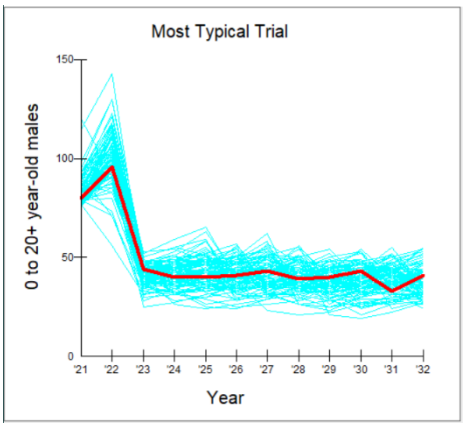
	Population Sizes in 12 Years*		
	Minimum	Average	Maximum
Lowest Trial	28	66	153
10th Percentile	38	75	178
25th Percentile	43	78	184
Median Trial	47	81	196
75th Percentile	51	83	211
90th Percentile	54	86	224
Highest Trial	60	92	279

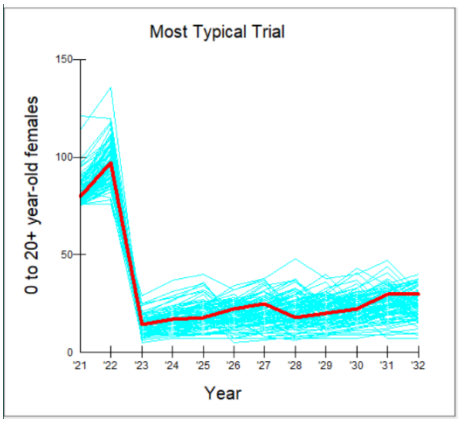
* 0 to 20+ year-old horses

Removals + Sex Ratio: Most Typical Trajectory

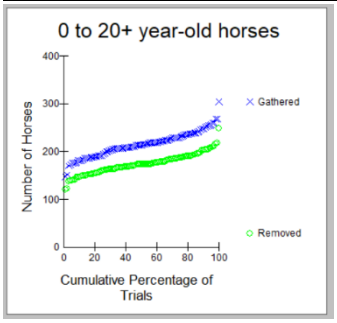


Both sexes combined: _____

Males: 

Females: 

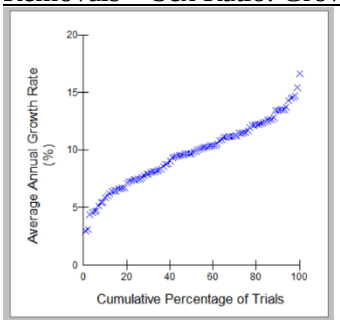
Removals + Sex Ratio: Gathers



	Totals in 12 Years*	
	Gathered	Removed
Lowest Trial	148	121
10th Percentile	182	148
25th Percentile	197	160
Median Trial	216	174
75th Percentile	233	188
90th Percentile	250	204
Highest Trial	305	249

* 0 to 20+ year-old horses

Removals + Sex Ratio: Growth Rate

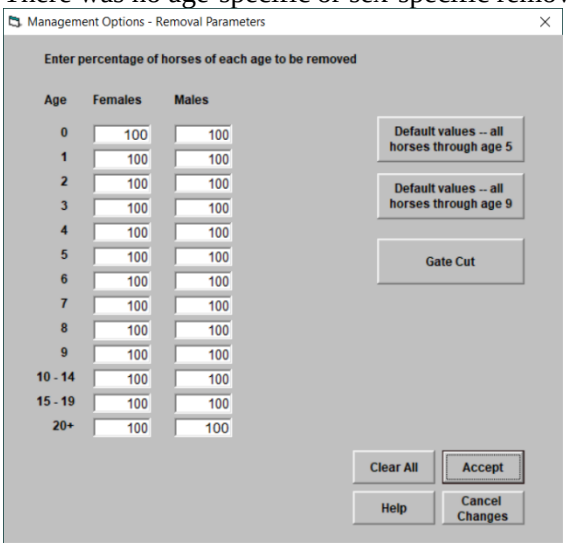


Average Growth Rate in 11	
Lowest Trial	3.0%
10th Percentile	6.0%
25th Percentile	7.5%
Median Trial	9.8%
75th Percentile	11.6%
90th Percentile	13.5%
Highest Trial	16.6%

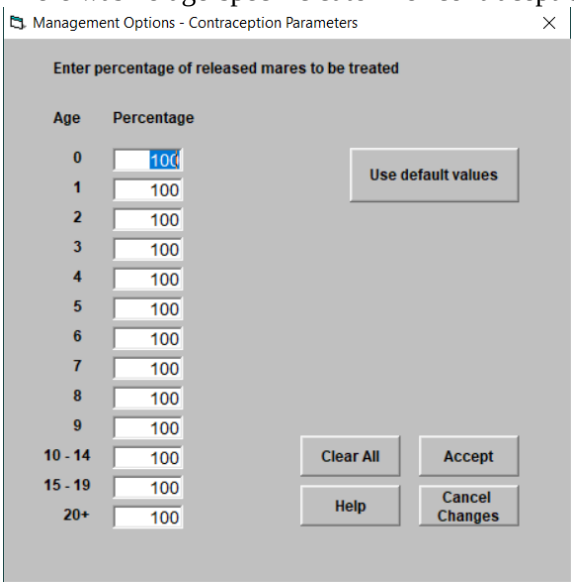
IV. Removals and Fertility Control Vaccines

Additional Model Input Assumptions:

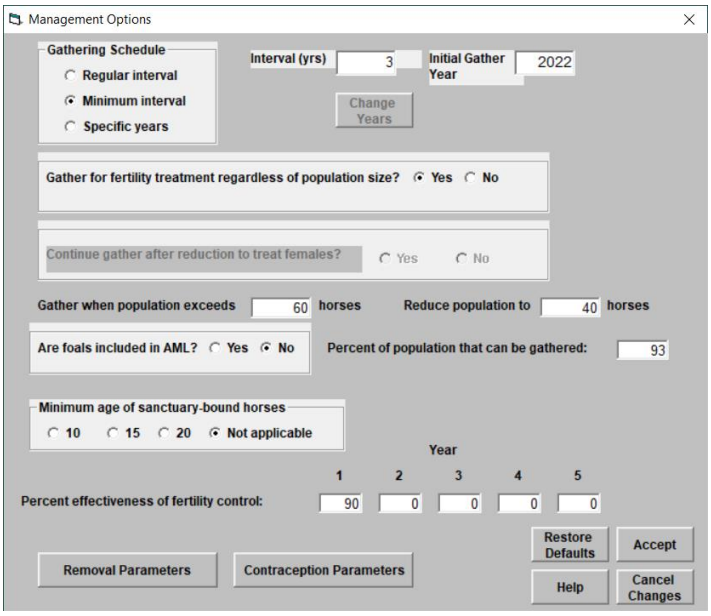
There was no age-specific or sex-specific removal criterion; it was a gate-cut removal.



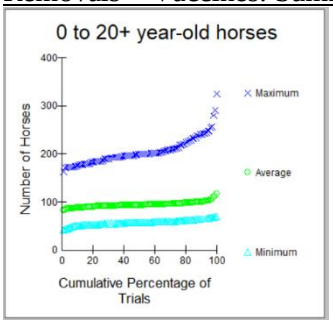
There was no age-specific cutoff for contraception application.



There was a minimum time interval of 3 years between gathers. Assumed fertility control efficacy was 90% for one year (i.e., equivalent to the ZonaStat-H PZP vaccine).



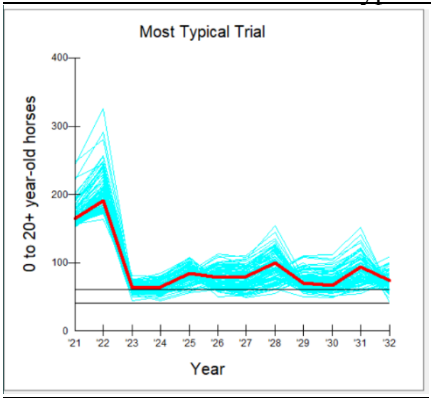
Removals + Vaccines: Summary of Population Size Simulations



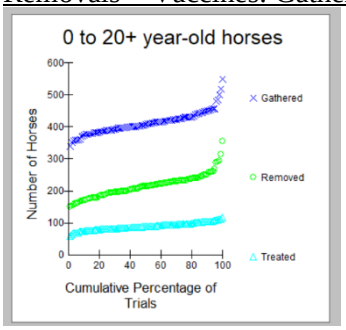
	Population Sizes in 12 Years*		
	Minimum	Average	Maximum
Lowest Trial	42	83	164
10th Percentile	50	88	177
25th Percentile	54	92	186
Median Trial	58	94	200
75th Percentile	61	97	217
90th Percentile	65	101	243
Highest Trial	70	117	325

* 0 to 20+ year-old horses

Removals + Vaccines: Most Typical Trajectory



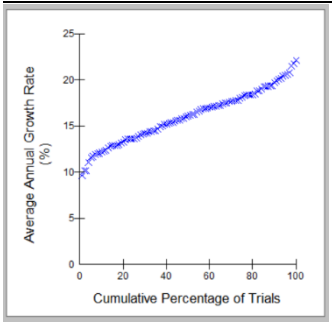
Removals + Vaccines: Gathers



	Totals in 12 Years*		
	Gathered	Removed	Treated
Lowest Trial	339	149	59
10th Percentile	376	171	74
25th Percentile	390	192	82
Median Trial	409	214	89
75th Percentile	431	233	97
90th Percentile	453	254	104
Highest Trial	549	354	116

* 0 to 20+ year-old horses

Removals + Vaccines: Growth Rate

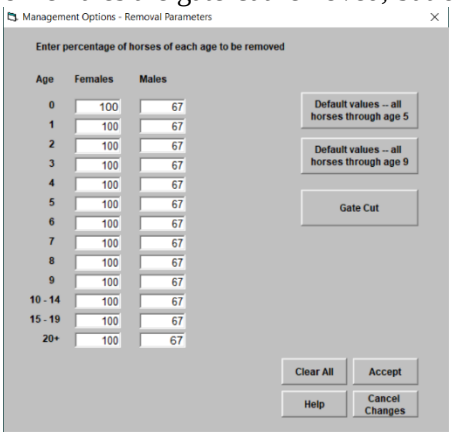


Average Growth Rate in 11 Years

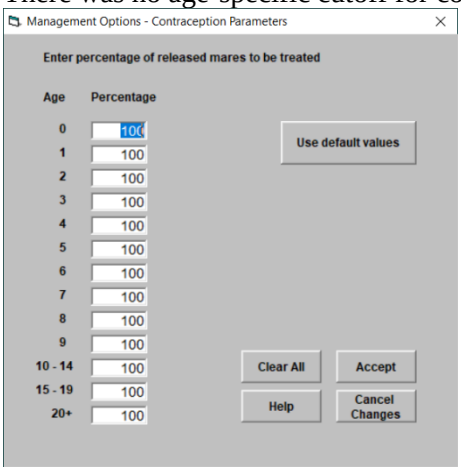
Lowest Trial	9.6%
10th Percentile	12.3%
25th Percentile	13.7%
Median Trial	16.2%
75th Percentile	18.2%
90th Percentile	19.8%
Highest Trial	22.1%

Removals + Vaccines + Sex Ratio Manipulation

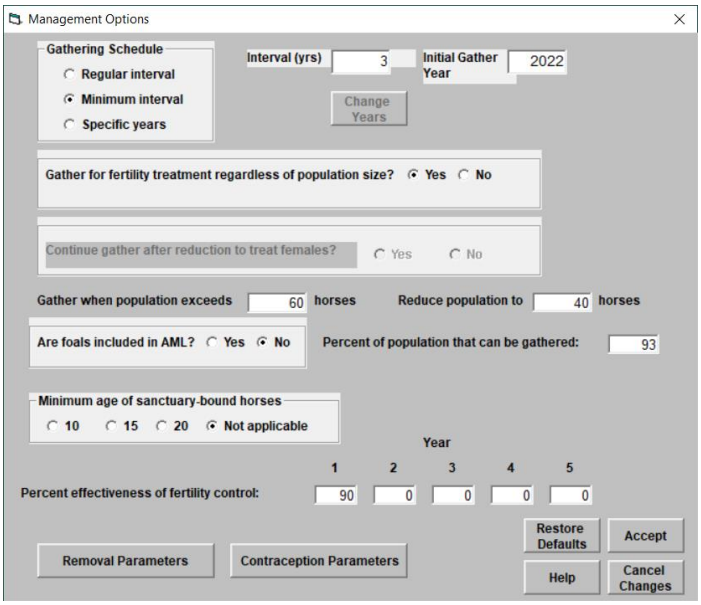
Additional model Input assumptions: Removals can take place any year when the population size exceeds high AML but minimum time period between removals is 3 years. The herd is removed down to low AML. Sex ratio removed is unequal: To achieve the approximate 60% male and 40% female sex ratio, the ratio of animals removed will be 60% female and 40% female (in WinEquus terms, this means that 100% of females are gate-cut removed, but 67% of males captured are removed).



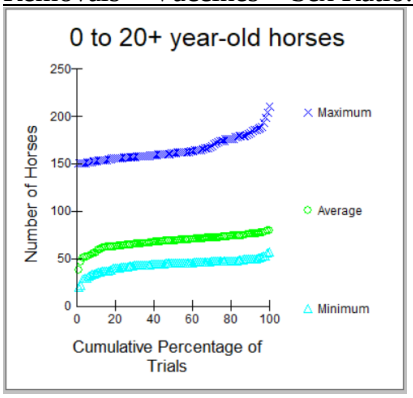
There was no age-specific cutoff for contraception application.



There was a minimum time interval of 3 years between gathers. Assumed fertility control efficacy was 90% for one year (i.e., equivalent to the ZonaStat-H PZP vaccine).



Removals + Vaccines + Sex Ratio: Summary of Population Size Simulations

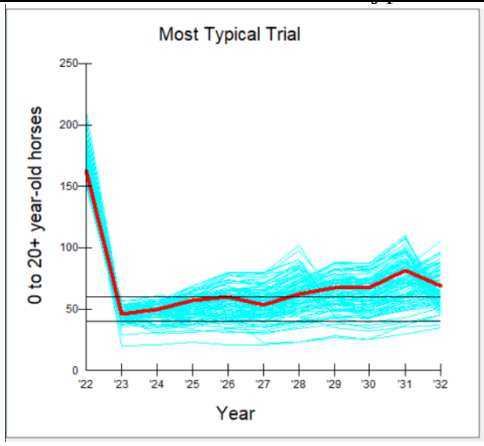


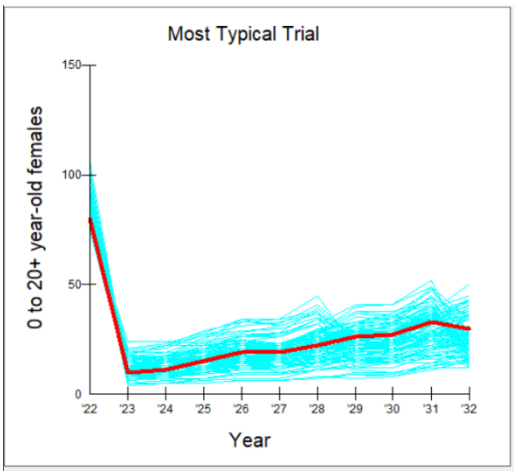
Population Sizes in 11 Years*	Minimum	Average	Maximum
Lowest Trial	20	38	151
10th Percentile	36	58	154
25th Percentile	41	64	157
Median Trial	45	69	162
75th Percentile	48	73	174
90th Percentile	50	76	184
Highest Trial	57	80	211

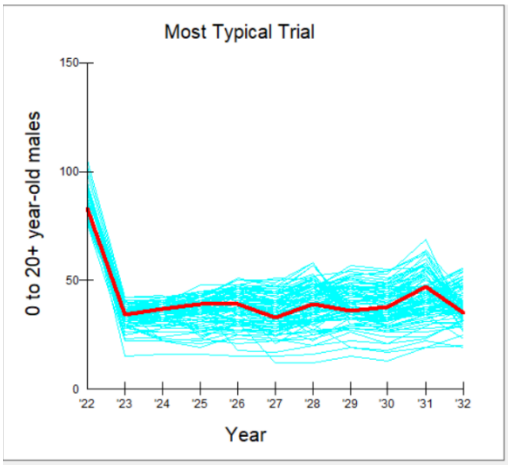
* 0 to 20+ year-old horses

Removals + Vaccines + Sex Ratio: Most Typical Trajectory

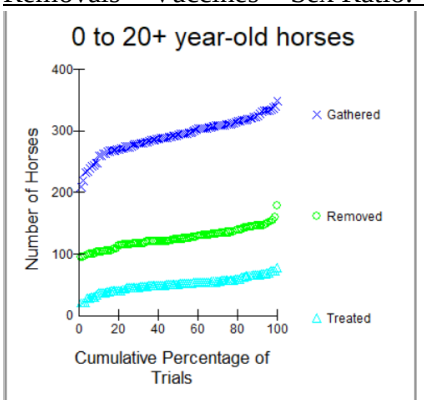
Both Sexes



Females 

Male 

Removals + Vaccines + Sex Ratio: Gathers

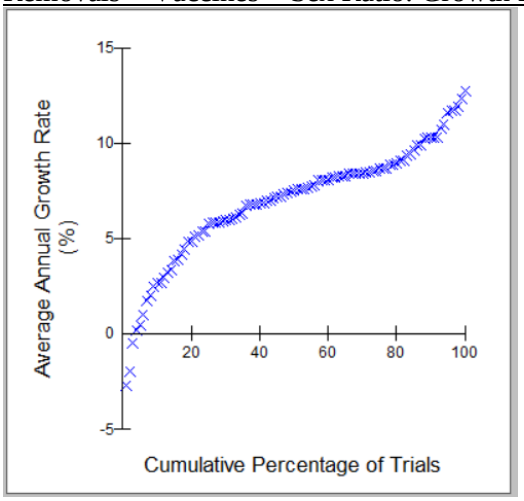


Totals in 11 Years*

	Gathered	Removed	Treated
Lowest Trial	209	95	21
10th Percentile	261	104	37
25th Percentile	276	116	45
Median Trial	295	124	51
75th Percentile	312	135	57
90th Percentile	327	146	66
Highest Trial	349	179	78

* 0 to 20+ year-old horses

Removals + Vaccines + Sex Ratio: Growth Rate



Average Growth Rate in 10 Years

Lowest Trial	-2.7%
10th Percentile	2.7%
25th Percentile	5.8%
Median Trial	7.6%
75th Percentile	8.7%
90th Percentile	10.3%
Highest Trial	12.7%

Literature Cited

Jenkins, S.H. 1996. Wild horse population model version 3.2. User's Guide. Department of Biology, University of Nevada, Reno, Nevada.

Ransom, J.I., L Lagos, H. Hrabar, H. Mowrazi, D. Ushkhjargal, and N. Spasskaya. 2016. Wild and feral equid population dynamics. Pages 68-86 in J. I. Ransom and P Kaczensky, eds., Wild equids; ecology, management and conservation. Johns Hopkins University Press, Baltimore, Maryland.

APPENDIX D: Standard Operating Procedures (SOPs) for Fertility Control Vaccines

SOPs common to all vaccine types:

Identification
Animals intended for treatment must be clearly, individually identifiable to allow for positive identification during subsequent management activities. For captured animals, marking for identification may be accomplished by marking each individual with a freeze mark on the hip and/ or neck and a microchip in the nuchal ligament. In some cases, identification may be accomplished based by cataloguing markings that make animals uniquely identifiable. Such animals may be photographed using a telephoto lens and high quality digital camera as a record of treated individuals.

Safety
Safety for both humans and animals is the primary consideration in all elements of fertility control vaccine use. Administration of any vaccine must follow all safety guidance and label guidelines on applicable EPA labeling.

Injection Site
For hand-injection, delivery of the vaccine should be by intramuscular injection, while the animal is standing still, into the left or right side, above the imaginary line that connects the point of the hip (hook bone) and the point of the buttocks (pin bone): this is the hip / upper gluteal area. For dart-based injection, delivery of the vaccine should be by intramuscular injection, while the animal is standing still, into the left or right thigh areas (lower gluteal / biceps femoralis).

Monitoring and Tracking of Treatments
1. Estimation of population size and growth rates (in most cases, using aerial surveys) should be conducted periodically after treatments.
2. Population growth rates of some herds selected for intensive monitoring may be estimated every year post-treatment using aerial surveys. If, during routine HMA field monitoring (on-the-ground), data describing adult to foal ratios can be collected, these data should also be shared with HQ-261.
3. Field applicators should record all pertinent data relating to identification of treated animals (including photographs if animals are not freeze-marked) and date of treatment, lot number(s) of the vaccine, quantity of vaccine issued, the quantity used, the date of vaccination, disposition of any unused vaccine, the date disposed, the number of treated mares by HMA, field office, and State along with the microchip numbers and freeze-mark(s) applied by HMA and date. A summary narrative and data sheets will be forwarded to HQ-261 annually. A copy of the form and data sheets and any photos taken should be maintained at the field office.
4. HQ-261 will maintain records sent from field offices, on the quantity of PZP issued, the quantity used, disposition of any unused PZP, the number of treated mares by HMA, field office, and State along with the freeze-mark(s) applied by HMA and date.

SOPs for one-year liquid PZP vaccine (ZonaStat-H)
ZonaStat-H vaccine (Science and Conservation Center, Billings, MT) would be administered through hand-injection or darting by trained BLM personnel or collaborating partners only. At present, the only PZP vaccine for dart-based delivery in BLM-managed wild horses or burros is ZonaStat-H. For any darting operation, the designated personnel must have successfully completed a nationally recognized wildlife darting course and who have documented and successful experience darting wildlife under field conditions.

Until the day of its use, ZonaStat-H must be kept frozen.

Animals that have never been treated with a PZP vaccine would receive 0.5 cc of PZP vaccine emulsified with 0.5 cc of Freund's Modified Adjuvant (FMA). Animals identified for re-treatment receive 0.5 cc of the PZP vaccine emulsified with 0.5 cc of Freund's Incomplete Adjuvant (FIA).

Hand-injection of liquid PZP vaccine would be by intramuscular injection into the gluteal muscles while the animal is restrained in a working chute. The vaccine would be injected into the left hind quarters of the animal, above the imaginary line that connects the point of the hip (hook bone) and the point of the buttocks (pin bone).

For Hand-injection, delivery of the vaccine would be by intramuscular injection into the left or right buttocks and thigh muscles (gluteals, biceps femoris) while the animal is standing still.

Application of ZonaStat-H via Darting
Only designated darters would prepare the emulsion. Vaccine-adjuvant emulsion would be loaded into darts at the darting site and delivered by means of a projector gun.

No attempt to dart should be taken when other persons are within a 100-m radius of the target animal. The Dan Inject gun should not be used at ranges in excess of 30 m while the Pneu-Dart gun should not be used over 50 m.

No attempts would be taken in high wind (greater than 15 mph) or when the animal is standing at an angle where the dart could miss the target area and hit the flank or rib cage. The ideal is when the dart would strike the skin of the animal at a 90° angle.

If a loaded dart is not used within two hours of the time of loading, the contents would be transferred to a new dart before attempting another animal. If the dart is not used before the end of the day, it would be stored under refrigeration and the contents transferred to another dart the next day, for a maximum of one transfer (discard contents if not used on the second day). Refrigerated darts would not be used in the field.

A darting team should include two people. The second person is responsible for locating fired darts. The second person should also be responsible for identifying the animal and keeping onlookers at a safe distance.

To the extent possible, all darting would be carried out in a discrete manner. However, if darting is to be done within view of non-participants or members of the public, an explanation of the nature of the project would be carried out either immediately before or after the darting.

Attempts will be made to recover all darts. To the extent possible, all darts which are discharged and drop from the target animal at the darting site would be recovered before another darting occurs. In exceptional situations, the site of a lost dart may be noted and marked, and recovery efforts made at a later time. All discharged darts would be examined after recovery in order to determine if the charge fired and the plunger fully expelled the vaccine. Personnel conducting darting operations should be equipped with a two-way radio or cell phone to provide a communications link with a project veterinarian for advice and/or assistance. In the event of a veterinary emergency, darting personnel would immediately contact the project veterinarian, providing all available information concerning the nature and location of the incident.

In the event that a dart strikes a bone or imbeds in soft tissue and does not dislodge, the darter would follow the affected animal until the dart falls out or the animal can no longer be found. The darter would be responsible for daily observation of the animal until the situation is resolved.

SOPs for application of PZP-22 pelleted vaccine:
PZP-22 pelleted vaccine treatment would be administered only by trained BLM personnel or designated partners.
A treatment of PZP-22 is comprised of two separate injections: (1) a liquid dose of PZP vaccine (equivalent to one dose of ZonaStat-H) is administered using an 18-gauge needle primarily by hand injection; (2) the pellets are preloaded into a 14-gauge needle. For animals constrained in a working chute, these are delivered using a modified syringe and jabstick to inject the pellets into the gluteal muscles of the animals being returned to the range. The pellets are intended to release PZP over time.
Until the day of its use, the liquid portion of PZP-22 must be kept frozen.

At this time, delivery of PZP-22 treatment would only be by intramuscular injection into the gluteal muscles while the animal is restrained in a working chute. The primer would consist of 0.5 cc of liquid PZP emulsified with 0.5 cc of adjuvant. Animals that have never been treated with a PZP vaccine would receive 0.5 cc of PZP vaccine emulsified with 0.5 cc of Freund's Modified Adjuvant (FMA). Animals identified for re-treatment receive 0.5 cc of the PZP vaccine emulsified with 0.5 cc of Freund's Incomplete Adjuvant (FIA). The syringe with PZP vaccine pellets would be loaded into the jabstick for the second injection. With each injection, the liquid or pellets would be injected into the left hind quarters of the animal, above the imaginary line that connects the point of the hip (hook bone) and the point of the buttocks (pin bone).
In the future, the PZP-22 treatment may be administered remotely using an approved long range darting protocol and delivery system if and when BLM has determined that the technology has been proven safe and effective for use.

SOPs for GonaCon-Equine Vaccine Treatments
GonaCon-Equine vaccine (USDA Pocatello Storage Depot, Pocatello, ID; Spay First!, Inc., Oklahoma City, OK) is distributed as preloaded doses (2 mL) in labeled syringes. Upon receipt, the vaccine should be kept refrigerated (4° C) until use. Do not freeze GonaCon-Equine. The

vaccine has a 6-month shelf-life from the time of production and the expiration date will be noted on each syringe that is provided.
For initial and booster treatments, mares would ideally receive 2.0 ml of GonaCon-Equine.
Administering GonaCon Vaccine by Hand-Injection
Experience has demonstrated that only 1.8 ml of vaccine can typically be loaded into 2 cc darts, and this dose has proven successful. Calculations below reflect a 1.8 ml dose.

For hand-injection, delivery of the vaccine should be by intramuscular injection, while the animal is standing still, into the left or right side, above the imaginary line that connects the point of the hip (hook bone) and the point of the buttocks (pin bone): this is the hip / upper gluteal area.

A booster vaccine may be administered after the first injection to improve efficacy of the product over subsequent years.

Application of GonaCon-Equine via Darting
General practice guidelines for darting operations, as noted above for dart-delivery of ZonaStat-H, should be followed for dart-delivery of GonaCon-Equine.

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

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

Darts should be weighed to the nearest hundredth gram by electronic scale when empty, when loaded with vaccine, and after discharge, to ensure that 90% (1.62 ml) of the vaccine has been injected. GonaCon weighs 0.95 grams/mL, so animals should receive 1.54 grams of vaccine to be considered treated. Animals receiving <50% should be darted with another full dose; those receiving >50% but <90% should receive a half dose (1 ml). All darts should be weighed to verify a combination of ≥1.62 ml has been administered. Therefore, every effort should be made to recover darts after they have fallen from animals.

Although infrequent, dart injections can result in partial injections of the vaccine, and shots are missed. As a precaution, it is recommended that extra doses of the vaccine be ordered to accommodate failed delivery (which may be as high as ~15 %). To determine the amount of vaccine delivered, the dart must be weighed before loading, and before and after delivery in the field. The scale should be sensitive to 0.01 grams or less, and accurate to 0.05 g or less.

For best results, darts with a gel barb should be used. (i.e. 2 cc Pneu-Dart brand darts configured with Slow-inject technology, 3.81 cm long 14 ga.tri-port needles, and gel collars positioned 1.27 cm ahead of the ferrule). One can expect updates in optimal dart configuration, pending results of research and field applications.

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

APPENDIX E: Scientific Literature Review

This appendix includes scientific literature reviews addressing three topics: effects of gathers, effects of wild horses and burros on rangeland ecosystems, and effects of fertility control vaccines and sex ratio manipulations.

Effects of Gathers on Wild Horses and Burros

Gathering any wild animals into pens has the potential to cause impacts to individual animals. There is also the potential for impacts to individual horses and burros during transportation, short-term holding, long-term holding that take place after a gather. However, BLM follows guidelines to minimize those impacts and ensure humane animal care and high standards of welfare. The following literature review summarizes the limited number of scientific papers and government reports that have examined the effects of gathers and holding on wild horses and burros.

Two early papers, by Hansen and Mosley (2000) and Ashley and Holcomb (2001) examined limited effects of gathers, including behavioral effects and effects on foaling rates. Hansen and Mosley (2000) observed BLM gathers in Idaho and Wyoming. They monitored wild horse behaviors before and after a gather event, and compared the behavioral and reproductive outcomes for animals that were gathered by helicopter against those outcomes for animals that were not. This comparison led to the conclusion that gather activities used at that time had no effect on observed wild horse foraging or social behaviors, in terms of time spent resting, feeding, vigilant, traveling, or engaged in agonistic encounters (Hansen and Mosley 2000). Similarly, the authors did not find any statistically significant difference in foaling rates in the year after the gather in comparisons between horses that were captured, those that were chased by a helicopter but evaded capture, or those that were not chased by a helicopter. The authors concluded that the gathers had no deleterious effects on behavior or reproduction. Ashley and Holcomb (2001) conducted observations of reproductive rates at Garfield Flat HMA in Nevada, where horses were gathered in 1993 and 1997, and compared those observations at Granite Range HMA in Nevada, where there was no gather. The authors found that the two gathers had a short-term effect on foaling rates; pregnant mares that were gathered had lower foaling rates than pregnant mares that were not gathered. The authors suggested that BLM make changes to the gather methods used at that time, to minimize the length of time that pregnant mares are held prior to their release back to the range. Since the publications by Hansen and Mosley (2000) and by Ashley and Holcomb (2001), BLM did make changes to reduce the stress that gathered animals, including pregnant females, may experience as a result of gather and removal activities; these measures have been formalized as policy in the comprehensive animal welfare program (BLM IM 2015-151).

A thorough review of gather practices and their effects on wild horses and burros can be found in a 2008 report from the Government Accounting Office. The report found that the BLM had controls in place to help ensure the humane treatment of wild horses and burros (GAO 2008). The controls included SOPs for gather operations, inspections, and data collection to monitor animal welfare. These procedures led to humane treatment during gathers, and in short-term and long-term holding facilities. The report found that cumulative effects associated with the capture and removal of excess wild horses include gather-related mortality averaged only about 0.5% and approximately 0.7% of the captured animals, on average, are humanely euthanized due to pre-existing conditions (such as lameness or club feet) in accordance with BLM policy. Scasta (2019) found the same overall mortality rate (1.2%) for BLM WH&B gathers in 2010-2019, with a mortality rate of 0.25% caused directly by the gather, and a mortality rate of 0.94% attributable to euthanasia of animals with pre-existing conditions such as blindness or club-footedness. Scasta (2019) summarized mortality rates from 70 BLM WH&B gathers across nine states, from 2010-2019. Records for 28,821 horses and 2,005 burros came from helicopter and bait/water trapping. For wild burro bait / water trapping, mortality rates were 0.05% due to acute injury caused by the gather process, and death for burros with pre-existing conditions was 0.2% (Scasta 2019). For wild horse bait / water trapping, mortality rates were 0.3% due to acute injury, and the mortality rate due to pre-existing

conditions was 1.4% (Scasta 2019). For wild horses gathered with the help of helicopters, mortality rates were only slightly lower than for bait / water trapping, with 0.3% due to acute causes, and 0.8% due to pre-existing conditions (Scasta 2019). Scasta (2019) noted that for other wildlife species capture operations, mortality rates above 2% are considered unacceptable and that, by that measure, BLM WH&B "…welfare is being optimized to a level acceptable across other animal handling disciplines."

The GAO report (2008) noted the precautions that BLM takes before gather operations, including screening potential gather sites for environmental and safety concerns, approving facility plans to ensure that there are no hazards to the animals there, and limiting the speeds that animals travel to trap sites. BLM used SOPs for short-term holding facilities (e.g., corrals) that included procedures to minimize excitement of the animals to prevent injury, separating horses by age, sex, and size, regular observation of the animals, and recording information about the animals in a BLM database. The GAO reported that BLM had regular inspections of short-term holding facilities and that animals I there, ensuring that the corral equipment is up to code and that animals are treated with appropriate veterinary care (including that hooves are trimmed adequately to prevent injury). Mortality was found to be about 5% per year associated with transportation, short term holding, and adoption or sale with limitations. The GAO noted that BLM also had controls in place to ensure humane care at long-term holding facilities (i.e., pastures). BLM staff monitor the number of animals, the pasture conditions, winter feeding, and animal health. Veterinarians from the USDA Animal and Plant Health Inspection Service inspect long-term facilities annually, including a full count of animals, with written reports. Contract veterinarians provide animal care at long-term facilities, when needed. Weekly counts provide an incentive for contractors that operate long-term holding facilities to maintain animal health (GAO 2008). Mortality at long-term holding was found to be about 8% per year, on average (GAO 2008). The mortality rates at short-term and long-term holding facilities are comparable to the natural annual mortality rate on the range of about 16% per year for foals (animals under age 1), about 5-10% per year for horses ages 1-10 years, and about 10-25% for animals aged 10-20 years (Ransom et al. 2016).

In 2010, the American Association of Equine Practitioners (AAEP 2011) was invited by the BLM to visit the BLM operations and facilities, spend time on WH&B gathers and evaluate the management of the wild equids. The AAEP Task Force evaluated horses in the BLM Wild Horse and Burro Program through several visits to wild horse gathers, and short- and long-term holding facilities. The task force was specifically asked to "review animal care and handling within the Wild Horse and Burro Program, and make whatever recommendations, if any, the Association feels may be indicated, and if possible, issue a public statement regarding the care and welfare of animals under BLM management." In their report (AAEP 2011), the task force concluded "that the care, handling and management practices utilized by the agency are appropriate for this population of horses and generally support the safety, health status and welfare of the animals."

In June 2010 BLM invited independent observers organized by American Horse Protection Association (AHPA) to observe BLM gathers and document their findings. AHPA engaged four independent credentialed professionals who are academia-based equine veterinarians or equine specialists. Each observer served on a team of two, and was tasked specifically to observe the care and handling of the animals for a 3-4-day period during the gather process, and submit their findings to AHPA. An Evaluation Checklist was provided to each of the observers that included four sections: Gather Activities; Horse Handling During Gather; Horse Description; and Temporary Holding Facility. The independent group visited 3 separate gather operations and found that "BLM and contractors are responsible and concerned about the welfare of the horses before, during and after the gather process" and that "gentle and knowledgeable, used acceptable methods for moving horses… demonstrated the ability to review, assess and adapt procedures to ensure the care and well-being of the animals" (Greene et al. 2013).

BLM commissioned the Natural Resources Council of the National Academies of Sciences (NAS) to conduct an independent, technical evaluation of the science, methodology, and technical decision making

approaches of the BLM Wild Horse and Burro Management Program. Among the conclusions of their 2013 report, NAS (2013) concluded that wild horse populations grow at 15-20 percent a year, and that predation will not typically control population growth rates of free-ranging horses. The report (NAS 2013) also noted that, because there are human-created barriers to dispersal and movement (such as fences and highways) and no substantial predator pressure, maintaining a herd within an AML requires removing animals in roundups, also known as gathers, and may require management actions that limit population growth rates. The report (NAS 2013) examined a number of population growth suppression techniques, including the use of sterilization, fertility control vaccines, and sex ratio manipulation.
The effects of gathers as part of feral horse management have also been documented on National Park Service Lands. Since the 1980s, managers at Theodore Roosevelt National Park have used periodic gathers, removals, and auctions to maintain the feral horse herd size at a carrying capacity level of 50 to 90 horses (Amberg et al. 2014). In practical terms, this carrying capacity is equivalent to an AML. Horse herd sizes at those levels were determined to allow for maintenance of certain sensitive forage plant species. Gathers every 3-5 years did not prevent the herd from self-sustaining. The herd continues to grow, to the point that the NPS now uses gathers and removals along with temporary fertility control methods in its feral horse management (Amberg et al. 2014).

Effects of Wild Horses and Burros on Rangeland Ecosystems

The presence of wild horses and wild burros can have substantial effects on rangeland ecosystems, and on the capacity for habitat restoration efforts to achieve landscape conservation and restoration goals. While wild horses and burros may have some beneficial ecological effects, such benefits are outweighed by ecological damage they cause when herds are at levels greater than supportable by allocated, available natural resources (i.e., when herds are greater than AML).

In the biological sense, all free-roaming horses and burros in North America are feral, meaning that they are descendants of domesticated animals brought to the Americas by European colonists. Horses went extinct in the Americas by the end of the Pleistocene, about 10,000 years ago (Webb 1984; MacFadden 2005). Burros evolved in Eurasia (Geigl et al. 2016). The published literature refers to free-roaming horses and burros as either feral or wild. In the ecological context the terms are interchangeable, but the terms ‘wild horse’ and ‘wild burro’ are associated with a specific legal status. The following literature review on the effects of wild horses and burros on rangeland ecosystems draws on scientific studies of feral horses and burros, some of which also have wild horse or wild burro legal status. The following literature review draws on Parts 1 and 2 of the ‘Science framework for conservation and restoration of the sagebrush biome’ interagency report (Chambers et al. 2017, Crist et al. 2019).

Because of the known damage that overpopulated wild horse and burro herds can cause in rangeland ecosystems, the presence of wild horses and burros is considered a threat to Greater sage-grouse habitat quality, particularly in the bird species’ western range (Beever and Aldridge 2011, USFWS 2013). Wild horse population sizes on federal lands have more than doubled in the five years since the USFWS report (2013) was published (BLM 2018). On lands administered by the BLM, there were over 95,000 BLM-administered wild horses and burros as of March 1, 2020, which does not include foals born in 2020. Lands with wild horses and burros are managed for multiple uses, so it can be difficult to parse out their ecological effects. Despite this, scientific studies designed to separate out those effects, which are summarized below, point to conclusions that landscapes with greater wild horse and burro abundance will tend to have lower resilience to disturbance and lower resistance to invasive plants than similar landscapes with herds at or below target AML levels.

In contrast to managed livestock grazing, neither the seasonal timing nor the intensity of wild horse and burro grazing can be managed, except through efforts to manage their numbers and distribution. Wild horses live on the range year round, they roam freely, and wild horse populations have the potential to grow 15-20% per year (Wolfe 1980; Eberhardt et al. 1982; Garrott et al 1991; Dawson 2005; Roelle et al. 2010; Scorolli et al. 2010). Although this annual growth rate may be lower in some areas where mountain

lions can take foals (Turner and Morrison 2001, Turner 2015), horses tend to favor use of more open habitats (Schoenecker 2016) that are dominated by grasses and shrubs and where ambush is less likely. Horses can compete with managed livestock in forage selected (Scasta et al. 2016).

As a result of the potential for wild horse populations to grow rapidly, impacts from wild horses on water, soil, vegetation, and native wildlife resources (Davies and Boyd 2019) can increase exponentially unless there is active management to limit their population sizes. For the majority of wild horse herds, there is little overall evidence that population growth is significantly affected by predation (NAS 2013), although wild horse herd growth rates may be somewhat reduced by predation in some localized areas, particularly where individual cougars specialize on horse predation (Turner and Morrison 2001, Roelle et al. 2010). Andreasen et al. (2021) recently found that some mountain lions (*Puma concolor*) prey on young horses, particularly where horses are at very high densities and native ungulates are at very low densities. The greatest rate of predation on horses was in the Virginia Range, where the state of Nevada manages a herd of feral horses that is not federally protected. Where lion predation on horses was common, Andreasen et al. (2021) found that female lions preyed on horses year-round, but 13% or fewer of horses killed by lions were adults. BLM does not have the legal authority to regulate or manage mountain lion populations, and it is not clear whether there are any mountain lions in the Bordo Atravesado HMA that specialize on horse predation. Andreasen et al. (2021) concluded that "At landscape scales, cougar predation is unlikely to limit the growth of feral horse populations." Given the recent history of consistent growth in the ##### HMA wild horse herd, as documented by repeated aerial survey, the inference that predation does not limit local wild horse herd growth rates apparently applies.

The USFWS (2008), Beever and Aldridge (2011), and Chambers et al (2017) summarize much of the literature that quantifies direct ecosystem effects of wild horse presence. Beever and Aldridge (2011) present a conceptual model that illustrates the effects of wild horses on sagebrush ecosystems. In the Great Basin, areas without wild horses had greater shrub cover, plant cover, species richness, native plant cover, and overall plant biomass, and less cover percentage of grazing-tolerant, unpalatable, and invasive plant species, including cheatgrass, compared to areas with horses (Smith 1986; Beever et al. 2008; Davies et al. 2014; Zeigenfuss et al. 2014; Boyd et al. 2017). There were also measurable increases in soil penetration resistance and erosion, decreases in ant mound and granivorous small mammal densities, and changes in reptile communities (Beever et al. 2003; Beever and Brussard 2004; Beever and Herrick 2006; Ostermann-Kelm et al. 2009). Intensive grazing by horses and other ungulates can damage biological crusts (Belnap et al. 2001). In contrast to domestic livestock grazing, where post-fire grazing rest and deferment can foster recovery, wild horse grazing occurs year round. These effects imply that horse presence can have broad effects on ecosystem function that could influence conservation and restoration actions.

Many studies corroborate the general conclusion that wild horses can lead to biologically significant changes in rangeland ecosystems, particularly when their populations are overabundant relative to water and forage resources, and other wildlife living on the landscape (Eldridge et al. 2020). The presence of wild horses is associated with a reduced degree of greater sage-grouse lekking behavior (Muñoz et al. 2020). Moreover, increasing densities of wild horses, measured as a percentage above AML, are associated with decreasing greater sage-grouse population sizes, measured by lek counts (Coates et al. 2021). Horses are primarily grazers (Hanley and Hanley 1982), but shrubs – including sagebrush – can represent a large part of a horse's diet, at least in summer in the Great Basin (Nordquist 2011). Grazing by wild horses can have severe impacts on water source quality, aquatic ecosystems and riparian communities as well (Beever and Brussard 2000; Barnett 2002; Nordquist 2011; USFWS 2008; Earnst et al. 2012; USFWS 2012, Kaweck et al. 2018), sometimes excluding native ungulates from water sources (Ostermann-Kelm et al. 2008; USFWS 2008; Perry et al. 2015; Hall et al. 2016; Gooch et al. 2017; Hall et al. 2018). Impacts to riparian vegetation per individual wild horse can exceed impacts per individual domestic cow (Kaweck et al. 2018, Burdick et al. 2021). Bird nest survival may be lower in areas with wild horses (Zalba and Cozzani 2004), and bird populations have recovered substantially after livestock

and / or wild horses have been removed (Earnst et al. 2005; Earnst et al. 2012; Batchelor et al. 2015). Wild horses can spread nonnative plant species, including cheatgrass, and may limit the effectiveness of habitat restoration projects (Beever et al. 2003; Couvreur et al. 2004; Jessop and Anderson 2007; Loydi and Zalba 2009). Riparian and wildlife habitat improvement projects intended to increase the availability of grasses, forbs, riparian habitats, and water will likely attract and be subject to heavy grazing and trampling by wild horses that live in the vicinity of the project. Even after domestic livestock are removed, continued wild horse grazing can cause ongoing detrimental ecosystem effects (USFWS 2008; Davies et al. 2014) which may require several decades for recovery (e.g., Anderson and Inouye 2001).

Wild horses and burros may have ecologically beneficial effects, especially when herd sizes are low relative to available natural resources, but those ecological benefits do not typically outweigh damage caused when herd sizes are high, relative to available natural resources. Under some conditions, there may not be observable competition with other ungulate species for water (e.g., Meeker 1979), but recent studies that used remote cameras have found wild horses excluding native wildlife from water sources under conditions of relative water scarcity (Perry et al. 2015, Hall et al. 2016, Hall et al. 2018). Wild burros (and, less frequently, wild horses) have been observed digging 'wells;' such digging may improve habitat conditions for some vertebrate species and, in one site, may improve tree seedling survival (Lundgren et al. 2021). This behavior has been observed in intermittent stream beds where subsurface water is within 2 meters of the surface (Lundgren et al. 2021). The BLM is not aware of published studies that document wild horses or burros in the western United States causing similar or widespread habitat amelioration on drier upland habitats such as sagebrush, grasslands, or pinyon-juniper woodlands. Lundgren et al. (2021) suggested that, due to well-digging in ephemeral streambeds, wild burros (and horses) could be considered 'ecosystem engineers;' a term for species that modify resource availability for other species (Jones et al. 1994). Rubin et al. (2021) and Bleich et al. (2021) responded by pointing out that ecological benefits from wild horse and burro presence must be weighted against ecological damage they can cause, especially at high densities. In HMAs where wild horse and burro biomass is very large relative to the biomass of native ungulates (Boyce and McLoughlin 2021), they should probably also be considered 'dominant species' (Power and Mills 1995) whose ecological influences result from their prevalence on the landscape. Wild horse densities could be maintained at high levels in part because artificial selection for early or extended reproduction may mean that wild horse population dynamics are not constrained in the same way as large herbivores that were never domesticated (Boyce and McLoughlin 2021). Another potentially positive ecological effect of wild horses and burros is that they, like all large herbivores, redistribute organic matter and nutrients in dung piles (i.e., King and Gurnell 2007), which could disperse and improve germination of undigested seeds. This could be beneficial if the animals spread viable native plant seeds, but could have negative consequences if the animals spread viable seeds of invasive plants such as cheatgrass (i.e,, Loydi and Zalba 2009, King et al. 2019). Increased wild horse and burro density would be expected to increase the spatial extent and frequency of seed dispersal, whether the seeds distributed are desirable or undesirable. As is true of herbivory by any grazing animals, light grazing can increase rates of nutrient cycling (Manley et al. 1995) and foster compensatory growth in grazed plants which may stimulate root growth (Osterheld and McNaughton 1991, Schuman et al. 1999) and, potentially, an increase in carbon sequestration in the soil (i.e., Derner and Schuman 2007, He et al. 2011). However, when grazer density is high relative to available forage resources, overgrazing by any species can lead to long-term reductions in plant productivity, including decreased root biomass (Herbel 1982, Williams et al. 1968) and potential reduction of stored carbon in soil horizons. Recognizing the potential beneficial effects of low-density wild horse and burro herds, but also recognizing the totality of available published studies documented ecological effects of wild horse and burro herds, especially when above AML (as noted elsewhere), it is prudent to conclude that horse and burro herd sizes above AML may cause levels of disturbance that reduce landscapes' capacity for resilience in the face of further disturbance, such as is posed by extreme weather events and other consequences of climate change.

Most analyses of wild horse effects have contrasted areas with wild horses to areas without, which is a study design that should control for effects of other grazers, but historical or ongoing effects of livestock grazing may be difficult to separate from horse effects in some cases (Davies et al. 2014). Analyses have generally not included horse density as a continuous covariate; therefore, ecosystem effects have not been quantified as a linear function of increasing wild horse density. One exception is an analysis of satellite imagery confirming that varied levels of feral horse biomass were negatively correlated with average plant biomass growth (Ziegenfuss et al. 2014).

Horses require access to large amounts of water; an individual can drink an average of 7.4 gallons of water per day (Groenendyk et al. 1988). Despite a general preference for habitats near water (e.g., Crane et al. 1997), wild horses will routinely commute long distances (e.g., 10+ miles per day) between water sources and palatable vegetation (Hampson et al. 2010).

Wild burros can also substantially affect riparian habitats (e.g., Tiller 1997), native wildlife (e.g., Seegmiller and Ohmart 1981), and have grazing and trampling impacts that are similar to wild horses (Carothers et al. 1976; Hanley and Brady 1977; Douglas and Hurst 1983). Where wild burros and Greater sage-grouse co-occur, burros' year-round use of low-elevation habitats may lead to a high degree of overlap between burros and Greater sage-grouse (Beever and Aldridge 2011).

Effects of Fertility Control Vaccines and Sex Ratio Manipulations

Various forms of fertility control can be used in wild horses and wild burros, with the goals of maintaining herds at or near AML, reducing fertility rates, and reducing the frequency of gathers and removals. The WFRHBA of 1971 specifically provides for contraception and sterilization (16 U.S.C. 1333 section 3.b.1). Fertility control measures have been shown to be a cost-effective and humane treatment to slow increases in wild horse populations or, when used in combination with gathers, to reduce horse population size (Bartholow 2004, de Seve and Boyles-Griffin 2013, Fonner and Bohara 2017). Although fertility control treatments may be associated with a number of potential physiological, behavioral, demographic, and genetic effects, those impacts are generally minor and transient, do not prevent overall maintenance of a self-sustaining population, and do not generally outweigh the potential benefits of using contraceptive treatments in situations where it is a management goal to reduce population growth rates (Garrott and Oli 2013).

An extensive body of peer-reviewed scientific literature details the impacts of fertility control methods on wild horses and burros. No finding of excess animals is required for BLM to pursue contraception in wild horses or wild burros, but NEPA analysis has been required. This review focuses on peer-reviewed scientific literature. The summary that follows first examines effects of fertility control vaccine use in mares, then of sex ratio manipulation. This review does not examine effects of spaying and neutering. Cited studies are generally limited to those involving horses and burros, except where including studies on other species helps in making inferences about physiological or behavioral questions not yet addressed in horses or burros specifically. While most studies reviewed here refer to horses, burros are extremely similar in terms of physiology, such that expected effects are comparable, except where differences between the species are noted.

On the whole, the identified impacts are generally transient and affect primarily the individuals treated. Fertility control that affects individual horses and burros does not prevent BLM from ensuring that there will be self-sustaining populations of wild horses and burros in single herd management areas (HMAs), in complexes of HMAs, and at regional scales of multiple HMAs and complexes. Under the WFRHBA of 1971, BLM is charged with maintaining self-reproducing populations of wild horses and burros. The National Academies of Sciences (2013) encouraged BLM to manage wild horses and burros at the spatial scale of "metapopulations" – that is, across multiple HMAs and complexes in a region. In fact, many HMAs have historical and ongoing genetic and demographic connections with other HMAs, and BLM

routinely moves animals from one to another to improve local herd traits and maintain high genetic diversity. The NAS report (2013) includes information (pairwise genetic 'fixation index' values for sampled WH&B herds) confirming that WH&B in the vast majority of HMAs are genetically similar to animals in multiple other HMAs.

All fertility control methods affect the behavior and physiology of treated animals (NAS 2013), and are associated with potential risks and benefits, including effects of handling, frequency of handling, physiological effects, behavioral effects, and reduced population growth rates (Hampton et al. 2015). Contraception alone does not remove excess horses from an HMA's population, so one or more gathers are usually needed in order to bring the herd down to a level close to AML. Horses are long-lived, potentially reaching 20 years of age or more in the wild. Except in cases where extremely high fractions of mares are rendered infertile over long time periods of (i.e., 10 or more years), fertility control methods such as immunocontraceptive vaccines and sex ratio manipulation are not very effective at reducing population growth rates to the point where births equal deaths in a herd. However, even more modest fertility control activities can reduce the frequency of horse gather activities, and costs to taxpayers. Bartholow (2007) concluded that the application of 2-year or 3-year contraceptives to wild mares could reduce operational costs in a project area by 12-20%, or up to 30% in carefully planned population management programs. Because applying contraception to horses requires capturing and handling, the risks and costs associated with capture and handling of horses may be comparable to those of gathering for removal, but with expectedly lower adoption and long-term holding costs. Population growth suppression becomes less expensive if fertility control is long-lasting (Hobbs et al. 2000).

In the context of BLM wild horse and burro management, fertility control vaccines and sex ratio manipulation rely on reducing the number of reproducing females. Taking into consideration available literature on the subject, the National Academies of Sciences concluded in their 2013 report that forms of fertility control vaccines were two of the three 'most promising' available methods for contraception in wild horses and burros (NAS 2013). That report also noted that sex ratio manipulations where herds have approximately 60% males and 40% females can expect lower annual growth rates, simply as a result of having a lower number of reproducing females.

Fertility Control Vaccines

Fertility control vaccines (also known as (immunocontraceptives) meet BLM requirements for safety to mares and the environment (EPA 2009a, 2012). Because they work by causing an immune response in treated animals, there is no risk of hormones or toxins being taken into the food chain when a treated mare dies. The BLM and other land managers have mainly used three fertility control vaccine formulations for fertility control of wild horse mares on the range: ZonaStat-H, PZP-22, and GonaCon-Equine. As other formulations become available they may be applied in the future.

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. Adjuvants are additional substances that are included in vaccines to elevate the level of immune response. Adjuvants help to incite recruitment of lymphocytes and other immune cells which foster a long-lasting immune response that is specific to the antigen.

Liquid emulsion vaccines can be injected by hand or remotely administered in the field using a pneumatic dart (Roelle and Ransom 2009, Rutberg et al. 2017, McCann et al. 2017) in cases where mares are relatively approachable. Use of remotely delivered (dart-delivered) vaccine is generally limited to populations where individual animals can be accurately identified and repeatedly approached within 50 m (BLM 2010). Booster doses can be safely administered by hand or by dart. Even with repeated booster treatments of the vaccines, it is expected that most mares would eventually return to fertility, though some individual mares treated repeatedly may remain infertile. Once the herd size in a project area is at AML and population growth seems to be stabilized, BLM can make adaptive determinations as to the required

frequency of new and booster treatments.

BLM has followed SOPs for fertility control vaccine application (BLM IM 2009-090). Herds selected for fertility control vaccine use should have annual growth rates over 5%, have a herd size over 50 animals, and have a target rate of treatment of between 50% and 90% of female wild horses or burros. The IM requires that treated mares be identifiable via a visible freeze brand or individual color markings, so that their vaccination history can be known. The IM calls for follow-up population surveys to determine the realized annual growth rate in herds treated with fertility control vaccines.

Vaccine Formulations: Porcine Zona Pellucida (PZP)
PZP vaccines have been used on dozens of horse herds by the National Park Service, US Forest Service, Bureau of Land Management, and Native American tribes and PZP vaccine use is approved for free-ranging wild and feral horse herds in the United States (EPA 2012). PZP use can reduce or eliminate the need for gathers and removals, if very high fractions of mares are treated over a very long time period (Turner et al. 1997). PZP vaccines have been used extensively in wild horses (NAS 2013), and in feral burros on Caribbean islands (Turner et al. 1996, French et al. 2017). PZP vaccine formulations are produced as ZonaStat-H, an EPA-registered commercial product (EPA 2012, SCC 2015), as PZP-22, which is a formulation of PZP in polymer pellets that can lead to a longer immune response (Turner et al. 2002, Rutberg et al. 2017), and as Spayvac, where the PZP protein is enveloped in liposomes (Killian et al. 2008, Roelle et al. 2017, Bechert and Fraker 2018). 'Native' PZP proteins can be purified from pig ovaries (Liu et al. 1989). Recombinant ZP proteins may be produced with molecular techniques (Gupta and Minhas 2017, Joonè et al. 2017a, Nolan et al. 2018a).

When advisories on the product label (EPA 2015) are followed, the product is safe for users and the environment (EPA 2012). In keeping with the EPA registration for ZonaStat-H (EPA 2012; reg. no. 86833-1), certification through the Science and Conservation Center in Billings Montana is required to apply that vaccine to equids.

For maximum effectiveness, PZP is administered within the December to February timeframe. When applying ZonaStat-H, first the primer with modified Freund's Complete adjuvant is given and then the booster with Freund's Incomplete adjuvant is given 2-6 weeks later. Preferably, the timing of the booster dose is at least 1-2 weeks prior to the onset of breeding activity. Following the initial 2 inoculations, only annual boosters are required. For the PZP-22 formulation, each released mare would receive a single dose of the two-year PZP contraceptive vaccine at the same time as a dose of the liquid PZP vaccine with modified Freund's Complete adjuvant. The pellets are applied to the mare with a large gauge needle and jab-stick into the hip. Although PZP-22 pellets have been delivered via darting in trial studies (Rutberg et al 2017, Carey et al. 2019), BLM does not plan to use darting for PZP-22 delivery until there is more demonstration that PZP-22 can be reliably delivered via dart.

Vaccine Formulations: Gonadotropin Releasing Hormone (GnRH)
GonaCon (which is produced under the trade name GonaCon-Equine for use in feral horses and burros) is approved for use by authorized federal, state, tribal, public and private personnel, for application to free-ranging wild horse and burro herds in the United States (EPA 2013, 2015). GonaCon has been used on feral horses in Theodore Roosevelt National Park and on wild horses administered by BLM (BLM 2015). 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). 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.

As with other contraceptives applied to wild horses, the long-term goal of GonaCon-Equine use is to reduce or eliminate the need for gathers and removals (NAS 2013). GonaCon-Equine contraceptive 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. GonaCon is a pharmaceutical-grade vaccine, including aseptic manufacturing technique to deliver a sterile vaccine product (Miller et al. 2013). If stored at 4° C, the shelf life is 6 months (Miller et al 2013).

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

GonaCon-Equine can safely be reapplied as necessary to control the population growth rate; booster dose effects may lead to increased effectiveness of contraception, which is generally the intent. Even after booster treatment of GonaCon-Equine, it is expected that most, if not all, mares would return to fertility at some point. Although the exact timing for the return to fertility in mares boosted more than once with GonaCon-Equine has not been quantified, a prolonged return to fertility would be consistent with the desired effect of using GonaCon (e.g., effective contraception).

The adjuvant used in GonaCon, Adjuvac, generally leads to a milder reaction than Freund's Complete Adjuvant (Powers et al. 2011). Adjuvac contains a small number of killed *Mycobacterium avium* cells (Miller et al. 2008, Miller et al. 2013). The antigen and adjuvant are emulsified in mineral oil, such that they are not all presented to the immune system right after injection. It is thought that the mineral oil emulsion leads to a 'depot effect' that is associated with slow or sustained release of the antigen, and a resulting longer-lasting immune response (Miller et al. 2013). Miller et al. (2008, 2013) have speculated that, in cases where memory-B leukocytes are protected in immune complexes in the lymphatic system, it can lead to years of immune response. Increased doses of vaccine may lead to stronger immune reactions, but only to a certain point; when Yoder and Miller (2010) tested varying doses of GonaCon in prairie dogs, antibody responses to the 200μg and 400μg doses were equal to each other but were both higher than in response to a 100μg dose.

Direct Effects: PZP Vaccines

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

Research has demonstrated that contraceptive efficacy of an injected liquid PZP vaccine, such as ZonaStat-H, is approximately 90% or more for mares treated twice in the first year (Turner and Kirkpatrick 2002, Turner et al. 2008). The highest success for fertility control has been reported when the vaccine has been applied November through February. High contraceptive rates of 90% or more can be maintained in horses that are given a booster dose 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, Carey et al. 2019). Application of PZP for fertility control

would reduce fertility in a large percentage of mares for at least one year (Ransom et al. 2011). The contraceptive result for a single application of the liquid PZP vaccine primer dose along with PZP vaccine pellets (PZP-22), based on winter applications, can be expected to fall in the approximate efficacy ranges as follows (based on figure 2 in Rutberg et al. 2017). Below, the approximate efficacy is measured as the relative decrease in foaling rate for treated mares, compared to control mares:

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

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

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

The fraction of mares treated in a herd can have a large effect on the realized change in growth rate due to PZP contraception, with an extremely high portion of mares required over many years to be treated to totally prevent population-level growth (e.g., Turner and Kirkpatrick 2002). Gather efficiency does not usually exceed 85% via helicopter, and may be less with bait and water trapping, so there will almost always 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.

Direct Effects: GnRH Vaccines

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. When combined with an adjuvant, a GnRH vaccine stimulates a persistent immune response resulting in prolonged antibody production against GnRH, the carrier protein, and the adjuvant (Miller et al., 2008). The most direct result of successful GnRH vaccination is that it has the effect of decreasing the level of GnRH signaling in the body, as evidenced by a drop in luteinizing hormone levels, and a cessation of ovulation.

GnRH is highly conserved across mammalian taxa, so some inferences about the mechanism and effects of GonaCon-Equine in horses can be made from studies that used different anti-GnRH vaccines, in horses and other taxa. Other commercially available anti-GnRH vaccines include: Improvac (Imboden et al. 2006, Botha et al. 2008, Janett et al. 2009a, Janett et al. 2009b, Schulman et al. 2013, Dalmau et al. 2015, Nolan et al. 2018c), made in South Africa; Equity (Elhay et al. 2007), made in Australia; Improvest, for use in swine (Bohrer et al. 2014); Repro-BLOC (Boedeker et al. 2011); and Bopriva, for use in cows (Balet et al. 2014). Of these, GonaCon-Equine, Improvac, and Equity are specifically intended for horses. Other anti-GnRH vaccine formulations have also been tested, but did not become trademarked products (e.g., Goodloe 1991, Dalin et al 2002, Stout et al. 2003, Donovan et al. 2013, Schaut et al. 2018, Yao et al. 2018). The effectiveness and side-effects of these various anti-GnRH vaccines may not be the same as would be expected from GonaCon-Equine use in horses. Results could differ as a result of differences in the preparation of the GnRH antigen, and the choice of adjuvant used to stimulate the immune response. For some formulations of anti-GnRH vaccines, a booster dose is required to elicit a contraceptive response, though GonaCon can cause short-term contraception in a fraction of treated animals from one

dose (Powers et al. 2011, Gionfriddo et al. 2011a, Baker et al. 2013, Miller et al 2013).

GonaCon can provide multiple years of infertility in several wild ungulate species, including horses (Killian et al., 2008; Gray et al., 2010). The lack of estrus cycling that results from successful GonaCon vaccination has been compared to typical winter period of anoestrus in open mares. As anti-GnRH antibodies decline over time, concentrations of available endogenous GnRH increase and treated animals usually regain fertility (Power et al., 2011).

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, Nolan et al. 2018c). A leading hypothesis is that anti-GnRH antibodies bind GnRH in the hypothalamus – pituitary 'portal vessels,' preventing GnRH from binding to GnRH-specific binding sites on gonadotroph cells in the pituitary, thereby limiting the production of gonadotropin hormones, particularly luteinizing hormone (LH) and, to a lesser degree, follicle-stimulating hormone (FSH) (Powers et al. 2011, NAS 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.

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.

Several studies have monitored animal health after immunization against GnRH. GonaCon treated mares did not have any measurable difference in uterine edema (Killian 2006, 2008). Powers et al. (2011, 2013)

noted no differences in blood chemistry except a mildly elevated fibrinogen level in some GonaCon treated elk. In that study, one sham-treated elk and one GonaCon treated elk each developed leukocytosis, suggesting that there may have been a causal link between the adjuvant and the effect. Curtis et al. (2008) found persistent granulomas at GonaCon-KHL injection sites three years after injection, and reduced ovary weights in treated females. Yoder and Miller (2010) found no difference in blood chemistry between GonaCon treated and control prairie dogs. One of 15 GonaCon treated cats died without explanation, and with no determination about cause of death possible based on necropsy or histology (Levy et al. 2011). Other anti-GnRH vaccine formulations have led to no detectable adverse effects (in elephants; Boedeker et al. 2011), though Imboden et al. (2006) speculated that young treated animals might conceivably have impaired hypothalamic or pituitary function.

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

Reversibility and Effects on Ovaries: PZP Vaccines

In most cases, PZP contraception appears to be temporary and reversible, with most treated mares returning to fertility over time (Kirkpatrick and Turner 2002). The ZonaStat-H formulation of the vaccine tends to confer only one year of efficacy per dose. Some studies have found that a PZP vaccine in long-lasting pellets (PZP-22) can confer multiple years of contraception (Turner et al. 2007), particularly when boostered with subsequent PZP vaccination (Rutberg et al. 2017). Other trial data, though, indicate that the pelleted vaccine may only be effective for one year (J. Turner, University of Toledo, Personal Communication to BLM).

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

In some number of individual mares, PZP vaccination may cause direct effects on ovaries (Gray and Cameron 2010, Joonè et al. 2017b, Joonè et al. 2017c, Joonè et al. 2017d, Nolan et al. 2018b). Joonè et al. (2017a) noted reversible effects on ovaries in mares treated with one primer dose and booster dose. Joonè et al. (2017c) and Nolan et al. (2018b) documented decreased anti-Mullerian hormone (AMH) levels in mares treated with native or recombinant PZP vaccines; AMH levels are thought to be an indicator of ovarian function. Bechert et al. (2013) found that ovarian function was affected by the SpayVac PZP vaccination, but that there were no effects on other organ systems. Mask et al. (2015) demonstrated that equine antibodies that resulted from SpayVac immunization could bind to oocytes, ZP proteins, follicular tissues, and ovarian tissues. It is possible that result is specific to the immune response to SpayVac, which

may have lower PZP purity than ZonaStat or PZP-22 (Hall et al. 2016). However, in studies with native ZP proteins and recombinant ZP proteins, Joonè et al. (2017a) found transient effects on ovaries after PZP vaccination in some treated mares; normal estrus cycling had resumed 10 months after the last treatment. SpayVac is a patented formulation of PZP in liposomes that led to multiple years of infertility in some breeding trials (Killian et al. 2008, Roelle et al. 2017, Bechert and Fraker 2018), but unacceptably poor efficacy in a subsequent trial (Kane 2018). Kirkpatrick et al. (1992) noted effects on horse ovaries after three years of treatment with PZP. Observations at Assateague Island National Seashore indicated that the more times a mare is consecutively treated, the longer the time lag before fertility returns, but that even mares treated 7 consecutive years did eventually return to ovulation (Kirkpatrick and Turner 2002). Other studies have reported that continued PZP vaccine applications 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). Bagavant et al. (2003) demonstrated T-cell clusters on ovaries, but no loss of ovarian function after ZP protein immunization in macaques.

Reversibility and Effects on Ovaries: GnRH Vaccines

The NAS (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, 2018) than the one-year effect that is generally expected from a single booster of Zonastat-H.

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, 2018). 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, 2018). 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, Nolan et al. 2018c). It is worth repeating that those vaccines do not have the same formulation as GonaCon.

Results from horses (Baker et al. 2017, 2018) and other species (Curtis et al. 2001) suggest that providing a booster dose of GonaCon-Equine will increase the fraction of temporarily infertile animals to higher levels than would a single vaccine dose alone.

Longer-term infertility has been observed in some mares treated with anti-GnRH vaccines, including GonaCon-Equine. In a single-dose mare captive trial with an initial year effectiveness of 94%, 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, 2018). Similarly, gradually increasing fertility rates were observed after single dose treatment with GonaCon in elk (Powers et al. 2011) and deer (Gionfriddo et al. 2011a).

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

It is difficult to predict which females will exhibit strong or long-term immune responses to anti-GnRH vaccines (Killian et al. 2006, Miller et al. 2008, Levy et al. 2011). A number of factors may influence responses to vaccination, including age, body condition, nutrition, prior immune responses, and genetics (Cooper and Herbert 2001, Curtis et al. 2001, Powers et al. 2011). One apparent trend is that animals that are treated at a younger age, especially before puberty, may have stronger and longer-lasting responses (Brown et al. 1994, Curtis et al. 2001, Stout et al. 2003, Schulman et al. 2013). It is plausible that giving ConaGon-Equine to prepubertal mares will lead to long-lasting infertility, but 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. If long-term treatment resulted in permanent infertility for some treated mares, such permanent infertility fertility would be consistent with the desired effect of using GonaCon (e.g., effective contraception).

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

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

In summary, based on the above results related to fertility effects of GonaCon and other anti-GnRH vaccines, application of a single dose of GonaCon-Equine to gathered or remotely-darted wild horses could be expected to prevent pregnancy in perhaps 30%-60% 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 may lead to four or more years with relatively high rates (80+%) of additional infertility expected (Baker et al. 2018). 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. Similarly, not all animals may be approachable for darting. The uncaptured or undarted portion of the female population would still be expected to have normally high fertility rates in any given year, though those rates could go up slightly if contraception in other mares increases forage and water availability.

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

Effects on Existing Pregnancies, Foals, and Birth Phenology: PZP Vaccines

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

If a mare is already pregnant, the PZP vaccine has not been shown to affect normal development of the fetus or foal, or the hormonal health of the mare with relation to pregnancy (Kirkpatrick and Turner 2003). Studies on Assateague Island (Kirkpatrick and Turner 2002) showed that once female offspring born to mares treated with PZP during pregnancy eventually breed, they produce healthy, viable foals. It is possible that there may be transitory effects on foals born to mares or jennies treated with PZP. For example, in mice, Sacco et al. (1981) found that antibodies specific to PZP can pass from mother mouse to pup via the placenta or colostrum, but that did not apparently cause any innate immune response in the offspring: the level of those antibodies were undetectable by 116 days after birth. There was no indication in that study that the fertility or ovarian function of those mouse pups was compromised, nor is BLM aware of any such results in horses or burros. Unsubstantiated, speculative connections between PZP treatment and ‘foal stealing’ has not been published in a peer-reviewed study and thus cannot be verified.

'Foal stealing,' where a near-term pregnant mare steals a neonate foal from a weaker mare, is unlikely to be a common behavioral result of including spayed mares in a wild horse herd. McDonnell (2012) noted that "foal stealing is rarely observed in horses, except under crowded conditions and synchronization of foaling," such as in horse feed lots. Those conditions are not likely in the wild, where pregnant mares will be widely distributed across the landscape, and where the expectation is that parturition dates would be distributed across the normal foaling season. Similarly, although Nettles (1997) noted reported stillbirths after PZP treatments in cynomolgus monkeys, those results have not been observed in equids despite extensive use in horses and 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 give birth to foals out of season or late in the year (Kirkpatrick and Turner 2003). Nuñez's (2010) research showed that a small number of mares that had previously been treated with PZP foaled later than untreated mares and expressed the concern that this late foaling "may" impact foal survivorship and decrease band stability, or that higher levels of attention from stallions on PZP-treated mares might harm those mares. However, that paper provided no evidence that such impacts on foal survival or mare well-being actually occurred. Rubenstein (1981) called attention to a number of unique ecological features of horse herds on Atlantic barrier islands, such as where Nuñez made observations, which calls into question whether inferences drawn from island herds can be applied to western wild horse herds. Ransom et al. (2013), though, did identify a potential shift in reproductive timing as a possible drawback to prolonged treatment with PZP, stating that treated mares foaled on average 31 days later than non-treated mares. Results from Ransom et al. (2013), however, showed that over 81% of the documented births in that study were between March 1 and June 21, i.e., within the normal, peak, spring foaling season. Ransom et al. (2013) pointedly advised that managers should consider carefully before using fertility control vaccines in small refugia or rare species. Wild horses and burros managed by BLM do not generally occur in isolated refugia, nor are they at all rare species. The US Fish and Wildlife Service denied a petition to list wild horses as endangered (USFWS 2015). Moreover, any effect of shifting birth phenology was not observed uniformly: in two of three PZP-treated wild horse populations studied by Ransom et al. (2013), foaling season of treated mares extended three weeks and 3.5 months, respectively, beyond that of untreated mares. In the other population, the treated mares foaled within the same time period as the untreated mares. Furthermore, Ransom et al. (2013) found no negative impacts on foal survival even with an extended birthing season. If there are shifts in birth phenology, though, it is reasonable to assume that some negative effects on foal survival for a small number of foals might result from particularly severe weather events (Nuñez et al. 2018).

Effects on Existing Pregnancies, Foals, and Birth Phenology: GnRH Vaccines

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

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

GonaCon had no apparent effect on pregnancies in progress, foaling success, or the health of offspring, in horses that were immunized in October (Baker et al. 2013), elk immunized 80-100 days into gestation (Powers et al. 2011, 2013), or deer immunized in February (Miller et al. 2000). Kirkpatrick et al. (2011) noted that anti-GnRH immunization is not expected to cause hormonal changes that would lead to abortion in the horse, but this may not be true for the first 6 weeks of pregnancy (NAS 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 (NAS 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, but those effects are likely to be similar to those for PZP vaccine treated mares in which the effects of the vaccine wear off. It is possible that immunocontracepted mares returning to fertility late in the breeding season could give birth to foals at a time that is out of the normal range (Nuñez et al. 2010, Ransom et al 2013). Curtis et al. (2001) did observe a slightly later fawning date for GonaCon treated deer in the second year after treatment, when some does regained fertility late in the breeding season. In anti-GnRH vaccine trials in free-roaming horses, there were no published differences in mean date of foal production (Goodloe 1991, Gray et al. 2010). Unpublished results from an ongoing study of GonaCon treated free-roaming mares indicate that some degree of seasonal foaling is possible (D. Baker, Colorado State University, personal communication to Paul Griffin, BLM WH&B Research Coordinator). Because of the concern that contraception could lead to shifts in the timing of parturitions for some treated animals, Ransom et al. (2013) advised that managers should consider carefully before using PZP immunocontraception in small refugia or rare species; the same considerations could be advised for use of GonaCon, but wild horses and burros in most areas do not generally occur in isolated refugia, they are not a rare species at the regional, national, or international level, and genetically they represent descendants of domestic livestock with most populations containing few if any unique alleles (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.

Effects of Marking and Injection

Standard practices require that immunocontraceptive-treated animals be readily identifiable, either via brand marks or unique coloration (BLM 2010). Some level of transient stress is likely to result in newly captured mares that do not have markings associated with previous fertility control treatments. It is difficult to compare that level of temporary stress with the long-term stress that can result from food and water limitation on the range (e.g., Creel et al. 2013). Handling may include freeze-marking, for the purpose of identifying that mare and identifying her vaccine treatment history. Under past management

practices, captured mares experienced increased stress levels from handling (Ashley and Holcombe 2001), but BLM has instituted guidelines to reduce the sources of handling stress in captured animals (BLM 2015).

Most mares recover from the stress of capture and handling quickly once released back to the range, and none are expected to suffer serious long term effects from the fertility control injections, other than the direct consequence of becoming temporarily infertile. Injection site reactions associated with fertility control treatments are possible in treated mares (Roelle and Ransom 2009, Bechert et al. 2013, French et al. 2017, Baker et al. 2018), 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. 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. Use of remotely delivered vaccine is generally limited to populations where individual animals can be accurately identified and repeatedly approached. The dart-delivered PZP formulation produced injection-site reactions of varying intensity, though none of the observed reactions appeared debilitating to the animals (Roelle and Ransom 2009) but that was not observed with dart-delivered GonaCon (McCann et al. 2017). Joonè et al. (2017a) found that injection site reactions had healed in most mares within 3 months after the booster dose, and that they did not affect movement or cause fever.

Long-lasting 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. 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, 2018). 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).

Indirect Effects: PZP Vaccines

One expected long-term, indirect effect on wild horses treated with fertility control would be an improvement in their overall health (Turner and Kirkpatrick 2002). Many treated mares would not experience the biological stress of reproduction, foaling and lactation as frequently as untreated mares. The observable measure of improved health is higher body condition scores (Nuñez et al. 2010). After a treated mare returns to fertility, her future foals would be expected to be healthier overall, and would benefit from improved nutritional quality in the mare's milk. This is particularly to be expected if there is an improvement in rangeland forage quality at the same time, due to reduced wild horse population size. Past application of fertility control has shown that mares' overall health and body condition remains

improved even after fertility resumes. PZP treatment may increase mare survival rates, leading to longer potential lifespan (Turner and Kirkpatrick 2002, Ransom et al. 2014a) that may be as much as 5-10 years (NPS 2008). To the extent that this happens, changes in lifespan and decreased foaling rates could combine to cause changes in overall age structure in a treated herd (i.e., Turner and Kirkpatrick 2002, Roelle et al. 2010), with a greater prevalence of older mares in the herd (Gross 2000, NPS 2008). Observations of mares treated in past gathers showed that many of the treated mares were larger than, maintained higher body condition than, and had larger healthy foals than untreated mares (BLM, anecdotal observations).

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

Because successful fertility control in a given herd reduces foaling rates and population growth rates, another indirect effect should be to reduce the number of wild horses that have to be removed over time to achieve and maintain the established AML. Contraception may change a herd's age structure, with a relative increase in the fraction of older animals in the herd (NPS 2008). Reducing the numbers of wild horses that would have to be removed in future gathers could allow for removal of younger, more easily adoptable excess wild horses, and thereby could eliminate the need to send additional excess horses from this area to off-range holding corrals or pastures for long-term holding.

A principle motivation for use of contraceptive vaccines or sex ratio manipulation is to reduce population growth rates and maintain herd sizes at AML. Where successful, this should allow for continued and increased environmental improvements to range conditions within the project area, which would have long-term benefits to wild horse and burro habitat quality, and well-being of animals living on the range. 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. With rangeland conditions more closely approaching a thriving natural ecological balance, and with a less concentrated distribution of wild horses and burros, there should also be less trailing and concentrated use of water sources. Lower population density should lead to reduced competition among wild horses using the water sources, and less fighting among horses accessing water sources. Water quality and quantity would continue to improve to the benefit of all rangeland users including wild horses. Wild horses would also have to travel less distance back and forth between water and desirable foraging areas. Among mares in the herd that remain fertile, a higher level of physical health and future reproductive success would be expected in areas where lower horse and burro population sizes lead to increases in water and forage resources. 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 in almost every year.

Indirect Effects: GnRH Vaccines

As noted above to PZP vaccines, an expected long-term, indirect effect on wild horses treated with fertility control would be an improvement in their overall health. Body condition of anti-GnRH-treated females was equal to or better than that of control females in published studies. Ransom et al. (2014b) observed no difference in mean body condition between GonaCon-B treated mares and controls. Goodloe (1991) found that GnRH-KHL treated mares had higher survival rates than untreated controls. In other species, treated deer had better body condition than controls (Gionfriddo et al. 2011b), treated cats gained more weight than controls (Levy et al. 2011), as did treated young female pigs (Bohrer et al. 2014).

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

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

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

Behavioral Effects: PZP Vaccines

Behavioral difference, compared to mares that are fertile, should be considered as potential results of successful contraception. The NAS report (2013) noted that all forms of fertility suppression have effects on mare behavior, mostly because of the lack of pregnancy and foaling, and concluded that fertility control vaccines were among the most promising fertility control methods for wild horses and burros. The resulting impacts may be seen as neutral in the sense that a wide range of natural behaviors is already observable in untreated wild horses, or mildly adverse in the sense that effects are expected to be transient and to not affect all treated animals.

PZP vaccine-treated mares may continue estrus cycles throughout the breeding season. Ransom and Cade (2009) delineated wild horse behaviors. Ransom et al. (2010) found no differences in how PZP-treated and untreated mares allocated their time between feeding, resting, travel, maintenance, and most social behaviors in three populations of wild horses, which is consistent with Powell's (1999) findings in another population. Likewise, body condition of PZP-treated and control mares did not differ between

treatment groups in Ransom et al.'s (2010) study. Nuñez (2010) found that PZP-treated mares had higher body condition than control mares in another population, presumably because energy expenditure was reduced by the absence of pregnancy and lactation. Knight (2014) found that PZP-treated mares had better body condition, lived longer and switched harems more frequently, while mares that foaled spent more time concentrating on grazing and lactation and had lower overall body condition.

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

Ransom et al. (2010) found that control mares were herded by stallions more frequently than PZP-treated mares, and Nuñez et al. (2009, 2014, 2017, 2018) found that PZP-treated mares exhibited higher infidelity to their band stallion during the non-breeding season than control mares. Madosky et al. (2010) and Knight (2014) found this infidelity was also evident during the breeding season in the same population that Nuñez et al. (2009, 2010, 2014, 2017, 2018) studied. Nuñez et al. (2014, 2017, 2018) concluded that PZP-treated mares changing bands more frequently than control mares could lead to band instability. Nuñez et al. (2009), though, cautioned against generalizing from that island population to other herds. Also, despite any potential changes in band infidelity due to PZP vaccination, horses continued to live in social groups with dominant stallions and one or more mares. 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. In separate work in a long-term study of semi-feral Konik ponies, Jaworska et al. (2020) showed that neither infanticide nor feticide resulted for mares and their foals after a change in dominant stallion. Nuñez et al. 2014 wrote that these effects "…may be of limited concern when population reduction is an urgent priority." Nuñez (2018) and Jones et al. (2019, 2020) noted that band stallions of mares that have received PZP treatment can exhibit changes in behavior and physiology. Nuñez (2018) cautioned that PZP use may limit the ability of mares to return to fertility, but also noted that, "such aggressive treatments may be necessary when rapid reductions in animal numbers are of paramount importance…If the primary management goal is to reduce population size, it is unlikely (and perhaps less important) that managers achieve a balance between population control and the maintenance of more typical feral horse behavior and physiology."

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

The National Research Council (2013) found that harem changing was not likely to result in serious

adverse effects for treated mares:

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

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

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

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

Behavioral Effects: GnRH Vaccines

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. Where it is 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). Females treated with GonaCon had fewer estrous cycles than control or PZP-treated mares (Killian et al. 2006) or deer (Curtis et al. 2001). Thus, any concerns about PZP treated mares receiving more courting and breeding behaviors from stallions (Nuñez et al. 2009, Ransom et al. 2010) are not generally expected to be a concern for mares treated with anti-GnRH vaccines (Botha et al. 2008).

Ransom et al. (2014b) and Baker et al. (2018) 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. (2009a) and Baker et al. (2018) found no difference in sexual behaviors in mares treated with GonaCon and untreated mares. When progesterone levels are low, small changes in estradiol concentration can foster reproductive estrous behaviors (Imboden et al. 2006). Owners of anti-GnRH vaccine treated mares reported a reduced number of estrous-related behaviors under saddle (Donovan et al. 2013). Treated mares may refrain from reproductive behavior even after ovaries return to cyclicity (Elhay et al. 2007). Studies in elk found that GonaCon treated cows had equal levels of precopulatory behaviors as controls (Powers et al. 2011), though bull elk paid more attention to treated cows late in the breeding season, after control cows were already pregnant (Powers et al. 2011).

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

With respect to treatment with GonaCon or other anti-GnRH vaccines, it is probably less likely that treated mares will switch harems at higher rates than untreated animals, because treated mares are similar to pregnant mares in their behaviors (Ransom et al. 2014b). Indeed, Gray et al. (2009a) found no difference in band fidelity in a free-roaming population of horses with GonaCon treated mares, despite differences in foal production between treated and untreated mares. Ransom et al. (2014b) actually found increased levels of band fidelity after treatment, though this may have been partially a result of changes in overall horse density and forage availability.

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

Genetic Effects of Fertility Control Vaccines

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 NAS report (2013) recommended that single HMAs should not be considered as isolated genetic populations. Rather, managed herds of wild horses should be considered as components of interacting metapopulations, with the potential for interchange of individuals and genes taking place as a result of both natural and human-facilitated movements. Introducing 1-2 mares every generation (about every 10 years) is a standard management technique that can alleviated potential inbreeding concerns (BLM 2010).

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

Even if it is the case that repeated treatment with a fertility control vaccine 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 (i.e., see the table of Fst vales *in* NAS 2013). Roelle and Oyler-McCance (2015) used the VORTEX population model to simulate how different rates of mare sterility would influence population persistence and genetic diversity, in populations with high or low starting levels of genetic diversity, various starting population sizes, and various annual population growth rates. Their results show that the risk of the loss of genetic heterozygosity is extremely low except in case where all of the following conditions are met: starting levels of genetic diversity are low, initial population size is 100 or less, the intrinsic population growth rate is low (5% per year), and very large fractions of the female population are permanently sterilized.

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

One concern that has been raised with regards to genetic diversity is that treatment with immunocontraceptives could possibly lead to an evolutionary increase in the frequency of individuals whose genetic composition fosters weak immune responses (Cooper and Larson 2006, Ransom et al. 2014a).Many factors influence the strength of a vaccinated individual's immune response, potentially including genetics, but also nutrition, body condition, and prior immune responses to pathogens or other antigens (Powers et al. 2013). This premise is based on an assumption that lack of response to any given fertility control vaccine is a heritable trait, and that the frequency of that trait will increase over time in a population of vaccine-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). However, Magiafolou et al. (2013) clarify that if the variation in immune response is due to environmental factors (i.e., body condition, social rank) and not due to genetic factors, then there will be no expected effect of the immune phenotype on future generations. It is possible that general health, as measured by body condition, can have a causal role in determining immune response, with animals in poor condition demonstrating poor immune reactions (NAS 2013).

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

BLM is not aware of any studies that have quantified the heritability of a lack of response to immunocontraception such as PZP vaccine or GonaCon-Equine in horses or burros. 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 National Park, and Pryor Mountains Herd Management Area), 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, and is not expected to be used in the type of widespread or prolonged manner that might be required to cause a detectable evolutionary response.

Sex Ratio Manipulation

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

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

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

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

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

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

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

APPENDIX F: **STATISTICAL ANALYSIS FOR 2022 SURVEY OF HORSE ABUNDANCE**

M E M O R A N D U M

To: Bethany Rosales (BLM)
CC: Mark Matthews, Pat Williams, Angela Yemma, Paul Griffin, Scott Fluer, Hollè Waddell (BLM)
From: Michelle Crabb (BLM) WHB Program Population Biologist
Date: 06/9/2022
RE: Statistical analysis for 2022 survey of horse abundance in the Bordo Atravesado Herd Management Area, NM

Summary Table

Survey Areas and Dates	Start date	End date	Area name	Area ID
	3/19/2022	3/19/2022	Bordo Atravesado HMA	NM0001
Survey Type	Simultaneous double-observer			
Aviation Details	Pilot: Cameron Stallings, Aero Tech LLC, Helicopter: Bell 407, #N32AT			
Agency Personnel	Observers: Bethany Rosales, Mark Matthews, Angela Yemma (BLM) Helicopter manager: Collum Murray (USFS)			

Summary Narrative

In March 2022 Bureau of Land Management (BLM) personnel conducted a simultaneous double-observer aerial survey of the wild horse populations in the Bordo Atravesado Herd Management Area (HMA; Figure 1). Surveys were conducted using methods recommended by BLM policy (BLM 2010) and the National Academy of Sciences review (NRC 2013) with detailed field methods described in Griffin et al. (2020). These data were analyzed using methods in Ekernas and Lubow (2019) to estimate sighting probabilities for horses, with sighting probabilities then used to correct the raw counts for systematic biases (undercounts) that are known to occur in aerial surveys (Lubow and Ransom 2016), and to provide confidence intervals (which are measures of uncertainty) associated with the abundance estimates. Estimated abundance in each area is listed in Table 1, below.

Table 1. Estimated abundance (Estimate No. Horses) is for the number of horses in the surveyed areas at the time of survey. 90% confidence intervals are shown in terms of the lower limit (LCL) and upper limit (UCL). The coefficient of variation (CV) is a measure of precision; it is the standard error as a percentage of the estimated population. Number of horses seen (No. Horses Seen) leads to the estimated percentage of horses that were present in the surveyed area, but that were not recorded by any observer (Estimated % Missed). The estimated number of horses associated with each HMA but located outside the HMA's boundaries (Est. No. Horses Outside HMA) is already included in the total estimate for that HMA.

Area	Age Class	Estimated No. Horses	LCL[a]	UCL	Std Err	CV	No. Horses Seen	Estimated % Missed	Estimated No. Groups	Estimated Group Size	Foals Per 100 Adults[b]	Est. No. Horses Outside HMA
Bordo Atravesado HMA	Total	401	285	631	113.6	28.3%	218	45.6%	80	5.0	8.7	144
	Foals	32	17	58	13.0	40.7%	16					
	Adults	369	263	577	103.6	28.1%	202					

[a] The lower 90% confidence limit is based on bootstrap simulation results or the number of horses seen, whichever is higher.

[b] The estimated ratio of foals to adults reflects what was observed during this March survey and does not represent the full cohort of foals for this year.

Abundance Results

The estimated total horse abundance within the surveyed area is reported in Table 1. Observers recorded 43 horse groups, of which 37 horse groups had data recorded properly 'on protocol' and that could be used to compute statistical estimates of sighting probability. Of the 43 groups seen, 42 observations were used to calculate the abundance estimate. Any horse groups that were seen on two separate occasions (i.e., double counted), or that were identified as domestic and privately owned, were not used to calculate abundance; however, such groups can be used to parameterize sighting probability if they were recorded on protocol. Coefficient of variation (Table 1) values of less than 10% indicate high precision resulting from high detection probabilities; values between 10-20% indicate medium precision resulting from lower detection probabilities; and values greater than 20% indicate low precision resulting from very low detection probabilities.

The mean estimated size of detected horse groups, after correcting for missed groups, was 5.0 horses/group across the surveyed area, with a median of 5.0 horses/group. There were an estimated 8.7 foals per 100 adult horses at the time of the survey (Table 1). Surveys flown before July are unlikely to include all foals born this year, while surveys flown during or after July would not include foals that were born this year but died before the survey.

Sighting Probability Results

The combined front observers saw 64.9% of the horse groups (62.9% of the horses) seen by any observer, whereas the back seat observers saw 62.2% of all horse groups (62.9% of horses) seen (Table 2). At least one observer (front or back) missed 73% of horse groups seen by the other. These results demonstrate that simple raw counts do not fully reflect the true abundance without statistical corrections for missed groups, made possible by the double observer method and reported here. Direct counts from aerial surveys underestimate true abundance because some animals are missed by all observers; this analysis corrects for that bias (Lubow and Ransom 2016). The analysis method used for the surveyed areas was based on simultaneous double-observer data collected during the survey.

The sample size of observations following protocol was 37 horse groups. Survey datasets with sample size less than 20 groups cannot be analyzed using these methods; sample sizes of 20 to 40 groups are considered low and have high risk of containing unmodeled heterogeneity in sighting probability; sample sizes of 41-100 groups are moderate and can estimate effects of many but likely not all potential sightability covariates; and sample sizes >100 groups are large and can account for most sightability covariates.

All models used in the double-observer analysis contained an estimated intercept common to all observers. I evaluated 4 possible effects on sighting probability by fitting models for all possible combinations with and without the following additional effects, resulting in 16 alternative models. The 4 effects examined were: (1) horse group activity; (2) percent vegetation cover; (3) observations by front-seat observers on the pilot's side; and (4) effect for back-seat observers. I did not consider effects on detection probability of snow cover, rugged terrain, lighting conditions, visual field, or distance of horses from the flight path due to insufficient variation in the values of these covariates. Covariates and their relative effect on sighting probability are shown in Table 3.

There was strong support for an effect of observations by front-seat observers on the pilot's side (94.3% of AICc model weight). There was moderate support for an effect of moving animals (69.1%), and effect for back-seat observers (57.5%), and weak support for the effect of percent vegetation cover (25.1%). As expected, visibility was higher for horse groups that were moving, and lower for groups on the pilot side, and in dense vegetation cover (Table 3).

Groups that were recorded on the centerline, directly under the aircraft, were not available to backseat observers. For these groups, backseat observers' sighting probability was therefore set to 0. Sighting probability for groups visible on both sides of the aircraft was computed based on the assumption that both backseat observers could have independently seen them, thereby increasing total detection probability for these groups relative to groups available to only one side of the helicopter.

Estimated overall sighting probabilities, $\hat{p}$, for the combined observers ranged across horse groups from 0.26-0.91. Sighting probability was <0.7 for 24 (56%), <0.5 for 10 (23%), <0.4 for 4 (9%), and <0.3 for 3 (7%) of observed groups. In aggregate across all observed groups, the overall "correction factor" that was added on to the total number of wild horses *seen* was 83.9%. That is to say: 218 horses were seen, and adding another 83.9% of that number seen equals the total estimate of 401 horses (Table 1). A different but mathematically equivalent interpretation is listed in Table 1 in the "Estimated % Missed" column, which shows that, overall, 45.6% of the horses that were estimated to be present during the survey were *never seen* by any of the observers (Table 1).

Assumptions and Caveats

Results from this double observer analysis are a conservative estimate of abundance. True abundance values are likely to be higher, not lower, than abundance estimates in Table 1 because of several potential sources of bias listed below. Results should always be interpreted with a clear understanding of the assumptions and implications.

1. The results obtained from the survey are estimates of the horses present in the surveyed area at the time of the survey and should not be used to make inferences beyond this context. Abundance values reported here may vary from the annual March 1 population estimates for the HMA; aerial survey data are just one component of all the available information that BLM uses to make March 1 population estimates. Aerial surveys only provide information about the area surveyed at the time of the survey, and do not account for births, deaths, movements, or any management removals that may have taken place afterwards.

2. Simultaneous double-observer analyses cannot account for undocumented animal movement between, within, or outside of the surveyed area. Fences and topographic barriers can provide deterrents to animal movement, but even these barriers may not present continuous, unbroken, or impenetrable barriers. It is possible that the surveys did not extend as far beyond a boundary as horses might move. Also, due to fuel constraints, the survey did not cover the entire HMA (see below). Consequently, there is the possibility that temporary emigration from the surveyed area may have contributed to some animals that are normally resident having not being present at the time of survey. In principle, if the level of such movement were high, then the number of animals found within the survey area at another time could differ substantially. If there were any wild horses that are part of a local herd but were outside the surveyed areas, such as in the parts of the HMA that were not surveyed, then Table 1 underestimates true abundance.

3. The validity of the analysis rests on the assumption that all groups of animals are flown over once during a survey period, and thus have exactly one chance to be counted by the front and back seat observers, or that groups flown over more than once are identified and considered only once in the analysis. Animal movements during a survey can potentially bias results if those movements result in unintentional over- or under-counting of horses. Groups counted more than once would constitute 'double counting,' which would lead to estimates that are biased higher than the true number of groups present. Groups that were never available to be seen (for example due to temporary emigration out of the study area or undetected movement from an unsurveyed area to an already-surveyed area) can lead to estimates that are negatively biased compared to the true abundance.

Survey SOPs (Griffin et al. 2020) call for observers to identify and record 'marker' animals (with unusual coloration) on paper, and variation in group sizes helps reduce the risk of double counting during aerial surveys. Observers are also to take photographs of many observed groups and use those photos after landing to identify any groups that might have been inadvertently recorded twice. Unfortunately, there is no effective way to correct for the converse problem of horses fleeing and thus never having the opportunity for being detected. Because observers can account for horse movements leading to double counting, but cannot account for movement causing horses to never be observed, animal movements can contribute to the estimated abundance (Table 1) potentially being lower than true abundance.

4. The simultaneous double-observer method assumes that all horse groups with identical sighting covariate values have equal sighting probability. If there is additional variability in sighting probability not accounted for in the sighting models, such heterogeneity could lead to a negative bias (underestimate) of abundance. In other words, under most conditions the double-observer method underestimates abundance.

5. The analysis assumes that the number of animals in each group is counted accurately. Standard Operating Procedures (Griffin et al. 2020) specify that all groups with more than 20 animals are photographed and photos scrutinized after the flight to correct counts. Smaller groups, particularly ones with poor sighting conditions such as heavy tree cover, could also be undercounted. Any such undercounting would lead to biased estimates of abundance.

Evaluation of Survey and Recommendations

Observers appear to have been well trained, there were three observers (although there was not backseat rotation), and visibility conditions were excellent. Unfortunately, the sample size of 37 groups used for model building is low and has a high risk of containing unmodeled heterogeneity. This was unavoidable, because the herd size at Bordo Atravesado HMA is small, compared to some of the larger HMAs and complexes that BLM manages. Another reason for the low precision of the estimate was the low detection probabilities in this survey. The low sighting probabilities and precision estimated for these surveys, along with the relatively small sample size for model building, casts some doubt on the reliability of the population estimates presented here. Pooling data from Bordo Atravesado HMA surveys across multiple surveys and/or years would be helpful for the analysis, and I encourage that survey conditions be kept as reasonably similar across years (same aircraft type, the same pilot, same observers, same season, etc.) as much as possible to enable useful pooling of data for more precise estimates of sighting probability.

The same front seat observer and one backseat observer were the same for the 2016 and 2022 surveys, additionally the same person was recording data both years which is commendable. However, data from the 2016 survey were not able to be combined with the data from the 2022 survey for this analysis because a different type of helicopter was used, there was a different pilot (the pilot in 2022 detected very few groups), and drastically different sighting probabilities between 2016 and 2022 surveys (estimated percent missed 3.9% vs 45.6% respectively).

There is a pretty broad confidence interval around the herd size of estimate of 369 adults (Table 1). More precise estimates will be possible after accumulating more data from future surveys or pooling with surveys of other horse populations. However, to realize the benefits of pooling years, it is important to use the same observers, pilot, aircraft, procedures, and season as much as possible. If the same survey crew and aircraft could be used to survey the other area in New Mexico (Carracas Mesa HA) within a few weeks of the next survey at Bordo Atravesado HMA, the data for both units could be analyzed together, both improving the reliability of

the estimates and reducing analysis cost. Another option for increasing sample size would be to survey the same HMA or both the HMA and HA more than once, on consecutive days. If possible, backseat observers should be rotated during the survey, this is particularly important if new observer(s) are used. Similarly, if the backseat observers from the 2022 survey are observers in future surveys, they should sit on the opposite side of the helicopter (i.e., MM was sitting in the right back position in the 2020 survey, so MM should move to the left back position for the next survey).

It seems that some of the limitations on the survey results might be avoided in the future if there is a way to use the helicopter for 2 fuel cycles on the survey, instead of just one. That would extend the possible survey time, and allow the survey crew to cover the entire HMA, plus all surrounding areas where horses seem to be spreading, which is well beyond the HMA boundaries in some places. This would also allow for backseat observer rotation during the survey for better estimates. HQ can help with flight planning, so that fencelines or other features can be used to limit horse movements between areas that are covered on each flight.

Depending on how essential it is to have a more precise estimate of the population size this year, the Socorro FO could consider flying another survey later this year, preferably with the same crew and helicopter. It's not common to fly repeat surveys in one year, but it is not out of the norm when the number of observed groups is relatively low. In this case there would be big expected improvements in precision (a narrower confidence interval) because there would be more observations for statistical modeling, and because standard errors go down dramatically when two estimates of the same herd size are available from the same year.

The survey covered about 2/3 of the HMA due to time and fuel constraints, although the survey did extend beyond HMA boundary to the north, east, and southeast. Some groups of horses were observed near the edge of the surveyed area. That suggests that more horses could have been present in the areas just beyond what was surveyed. Steep terrain (Sierra Larga) appears to deter movement to the east of the survey area, although there are no other obvious natural deterrents to horse movements that would contain them within the boundaries of the HMA or survey area. Fencing in the area does not appear to contain horses to either the HMA or survey area. Consequently, it is difficult to be sure there were no additional horses inside and outside of the HMA, and results should be understood to represent the horses present only in the area surveyed, which may not represent all horses that occasionally occupy the Bordo Atravesado HMA and immediate vicinity. Careful consideration should be given to where horses were located near the edge of the area surveyed when planning whether to extend the survey area further in future surveys to ensure covering all areas potentially occupied by horses associated with the HMA, or to confirm that the current survey boundaries do cover the full extent of horses' range in this area.

Table 2. Tally of raw counts of horses and horse groups by observer (front, back, and both) for Bordo Atravesado HMA, surveyed in March 2022.

Observer	Groups seen[a] (raw count)	Horses seen[a] (raw count)	Actual sighting rate[b] (groups)	Actual sighting rate[b] (horses)
Front	24	117	64.9%	62.9%
Back	23	117	62.2%	62.9%
Both	10	48	27.0%	25.8%
Combined	37	186		

[a] Includes only groups and horses where protocol was followed.
[b] Percentage of all groups seen that were seen by each observer.

Table 3. Effect of observers and sighting condition covariates on estimated sighting probability of horse groups for both front and rear observers during the March 2022 survey of the Bordo Atravesado HMA. Baseline case (bold) for horses presents the predicted sighting probability for a group of 5 horses (the median group size observed), not moving, in 0% vegetation cover, not on the pilot side, and with the average back-seat observer. Other example cases vary a covariate or observer, one effect at time, as indicated in the left-most column, to illustrate the relative magnitude of each effect. Sighting probabilities for each row should be compared to the baseline (first row) to see the effect of the change in each observer or condition. Baseline values are shown in bold wherever they occur. Sighting probabilities are weighted averages across all 16 models considered (Burnham and Anderson 2002).

	Sighting probability		
	Front Observer[a]	Back Observer[b]	Combined Observers
Baseline	**35.6%**	**25.9%**	52.3%
Effect of Moving	66.2%	54.7%	84.7%
Effect of Veg= 30%	31.6%	22.6%	47.1%
Effect of Veg= 60%	28.9%	20.5%	43.5%
Effect of Pilot's Side	8.4%	**25.9%**	32.1%
Effect of back=front	**35.6%**	35.6%	58.5%

[a] Sighting probability for the front observers acting as a team, regardless of which of the front observers saw the horses first.
[b] Sighting probabilities for back observers for horse groups that are potentially visible on the same side of the aircraft as the observer. Sighting probability in the back is 0 for groups on the opposite side or centerline. line.

Literature Cited

Bureau of Land Management. 2010. Wild horse and burro population inventory and estimation: Bureau of Land Management Instructional Memorandum No. 2010-057. 4 p.

Burnham, K., and D. R. Anderson. 2002. Model Selection and Multimodel Inference: A Practical Information-Theoretic Approach. Springer-Verlag, New York, New York.

Ekernas, L. S., and B. C. Lubow. 2019. R script to analyze wild horse and burro double-observer aerial surveys. USGS Software Release.

Griffin, P. C., L.S. Ekernas, K.A. Schoenecker, and B. C. Lubow. 2020. Standard Operating Procedures for wild horse and burro double-observer aerial surveys. U.S. Geological Survey Techniques and Methods, book 2, chap. A16, 76 p., https://doi.org/10.3133/tm2A16.

Lubow, B. C., and J. I. Ransom. 2016. Practical bias correction in aerial surveys of large mammals: validation of hybrid double-observer with sightability method against known abundance of feral horse (Equus caballus) populations. PLoS-ONE 11(5):e0154902. doi:10.1371/journal.pone.0154902.

National Research Council. 2013. Using Science to Improve the BLM Wild Horse and Burro Program. The National Academies Press. Washington, D.C.

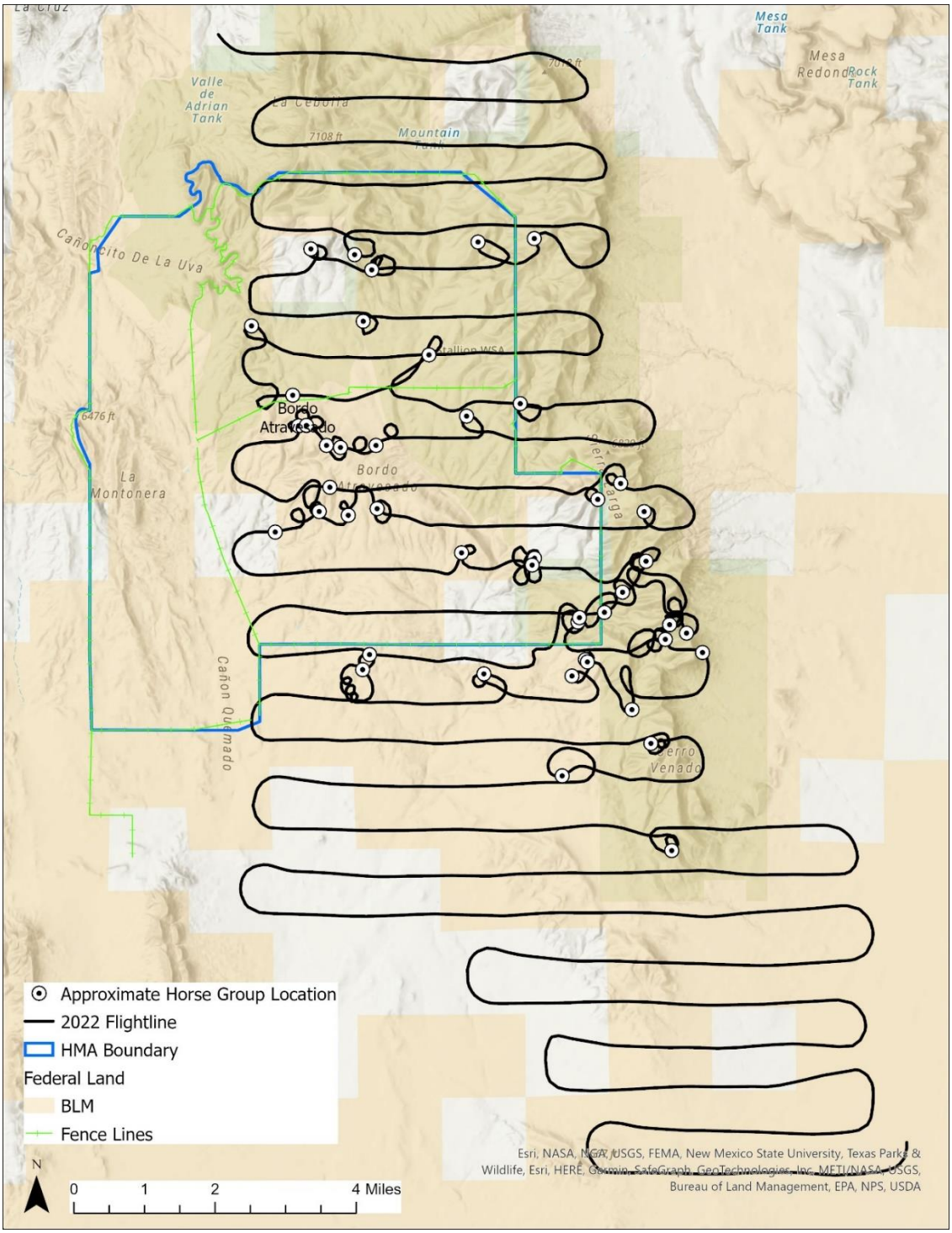


Figure 1. Map of 2022 Bordo Atravesado HMA, survey tracks flown (black lines), approximate locations of observed horse groups (black and white circles), HMA boundaries (blue).

Appendix G

An Environmental Assessment (EA) for the Bordo Atravesado Wild Horse Herd Management Area Gather Plan DOI-BLM-NM-A020-2022-0014-EA was available to the public for a 30-day review/comment period beginning on July 27, 2022. Comments were received from numerous individuals and organizations. Many of the comments could be clarified or answered by referring to sections within the EA. Others were outside the scope of the document. Changes were made to the EA based upon the comments. Below is a summary of the comments received and BLM responses.

	Sender Name	Organization	Comment Form / Date Received	Comment	BLM Response
1	Falk, Rebecca	Individual	ePlanning 8-24-22	"If you must do something follow your own law 43 c.f.r 47105 that states livestock needs to be removed in a drought. before wild horses"	Removal or reduction of livestock was an alternative considered but dismissed from analysis. Livestock grazing can only be reduced or eliminated if the BLM follows regulations at 43 CFR §4100 and must be consistent with multiple-use allocations set forth in the land-use plan. Forage allocations are addressed at the planning level. Such changes to livestock grazing cannot be made through a wild horse and burro gather decision or through 4710.5(a), and are only possible if the BLM first revises the land-use plans to allocate livestock forage to wild horses and to eliminate or reduce livestock grazing.
2	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to consider 43 C.F.R. 4710.5; the BLM cannot claim that this statute is usually applied in cases of emergency and not for general management of wild horses since it cannot be applied in a manner that would be inconsistent with the existing land-use plans."	Refer to comment response #1
3	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to take a hard look at the BLM's clear authority to limit	BLM has determined that it is necessary to remove excess wild horses from the Bordo Atravesado HMA

	Sender Name	Organization	Comment Form / Date Received	Comment	BLM Response
				livestock grazing, pursuant to 43 C.F.R. 4710.5(a), to close livestock grazing on areas of public lands:…"	following its review of the available monitoring data. The appropriate management action is to remove the excess horses for the health of the range and for their own well-being. To the extent this comment suggests that livestock grazing should be eliminated, even though resource damage is directly attributable to the wild horses, livestock grazing can only be reduced or eliminated if the BLM follows regulations at 43 CFR § 4100 and must be consistent with multiple use allocations set forth in the land-use plan. Forage allocations are addressed at the planning level. Such changes to livestock grazing cannot be made through a wild horse gather decision or through 4710.5(a), and are only possible if BLM first revises the land-use plans to allocate livestock forage to wild horses and to eliminate or reduce livestock grazing. Administration of livestock grazing on public lands fall under 43 CFR Subpart D, Group 4100. Additionally, livestock grazing is also managed under each District's respective RMP. Livestock grazing on public lands is also provided for in the Taylor Grazing act of 1934. Removal or reduction of livestock would not be in conformance with the existing RMP, is contrary to the BLM's multiple-use mission as outlined in the FLPMA and PRIA, and would be inconsistent with the WFRHBA, which directs the Secretary to immediately remove excess wild horses when such removal is necessary. Additionally, this would only be effective for the very short term as the horse population would continue to increase even further beyond the current

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					overpopulation and would cause range damage even with fewer or no livestock. Eventually the HMA and adjacent lands would become even more degraded and would not only not be capable of supporting the wild horse populations but would also not be able to support wildlife or other multiple uses of the public lands. By law, BLM is required to manage wild horses in a thriving natural ecological balance and multiple use relationship on the public lands and to remove excess immediately upon a determination that excess wild horses exist. BLM cannot use regulations at 43 CFR 4710.5 to manage wild horses and livestock in a manner that is inconsistent with the RMPs. A land-use plan amendment or revision would be necessary to reallocate use in this manner between livestock and wild horses. Livestock adjustments have been made through other actions and documents, after following the required regulatory process for grazing decisions. The purpose of the EA is not to adjust livestock use. There is no requirement of the WFRHBA or the regulations to reduce or eliminate livestock as a means to restore TNEB. Administration of Livestock grazing on public lands fall under 43 CFR Part 4100 regulations. Livestock grazing on public lands is also provided for in the Taylor Grazing act of 1934.
4	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to take a hard look at implementing BLM authority, and	43 C.F.R. 4710.3-2 states "Herd management areas may also be designated as wild horse or burro ranges

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				requirement as discussed above, to utilize its Adaptive Management mandate and its ability as per 43 C.F.R. 4710.3-2 and 43 C.F.R. 4710.5(a), which allows for the reduction or elimination of grazing for privately-held animals in order to improve conditions and forage availability for federally-protected wild horses or burros…“	to be managed principally, **but not necessarily exclusively,** for wild horse or burro herds.” However, the Bordo Atravesado HMA has not been designated a ‘range,’ and the decision to do so would be a land use planning change that is outside the scope of this decision.
5	Adams, Tammi	Individual	ePlanning 8-19-22	“The agency states, “The Action Alternatives are in conformance with the Wild Free-Roaming Horses and Burros Act of 1971 (as amended), applicable regulations at 43 CFR § 4700, and BLM policies.” (Page 2). 43 CFR § 4720.1 Removal of excess animals from public lands: Upon examination of current information and a determination by the authorized officer shall remove the excess animals immediately. The agency arbitrarily omits the conditions of this CFR law…”	§ 4720.1 Removal of excess animals from public lands. Upon examination of current information and a determination by the authorized officer that an excess of wild horses or burros exists, the authorized officer shall remove the excess animals immediately in the following order. (a) Old, sick, or lame animals shall be destroyed in accordance with subpart 4730 of this title; (b) Additional excess animals for which an adoption demand by qualified individuals exists shall be humanely captured and made available for private maintenance in accordance with subpart 4750 of this title; and (c) Remaining excess animals for which no adoption demand by qualified individuals exists shall be destroyed in accordance with subpart 4730 of this title.

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6	Odowd, Patience WHOA	WHOA	Email 8-29-22	"The Soccoro Field Office sites 43 CFR § 4720.1 but does not mention: that wild horses are to be managed princeably. 43 CFR § 4720.1 Removal of excess animals from public lands: Upon examination of current information and a determination by the authorized officer shall remove the excess animals immediately…"	Refer to comment response #4
7	Oregon Wild Horse Organization	Interest Group	ePlanning 8-27-22	"The EA at pg. 2 also states:"43 CFR 4700.0-6 (a) Wild horses shall be managed as self-sustaining populations of healthy animals in balance with other uses and the productive capacity of their habitat (emphasis added)." If this herd is brought down to 40 horses, and the sex ratio is skewed for 60:40 male/female, this would be 16 mares, and 24 stallions. There is no possible way that 16 mares, who are treated with fertility control vaccines are going to be a viable breeding population. This is further unlikely when consideration of other factors, such as predation are taken into account (discussed further below). This plan does not conform to 43 CFR 4700.0-6(a) which mandates BLM manage for a "self-sustaining" herd."	See page 3 of the EA for (Alternative A) The 60:40 ratio would only apply if Alternative B were selected. As discussed in the EA, the Bordo Atravesado HMA herd is considered to be part of a larger metapopulation of wild horses, and not managed as if they were a genetically isolated, endemic population of a rare species.

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8	American Wild Horse Campaign	Interest Group	ePlanning 8-26-22	"the final EA should explicitly reference which short-term holding facility or facilities these horses would be sent to, include an analysis of the recent Comprehensive Animal Welfare Program ("CAWP") assessment(s) of the facility or facilities, and incorporate a plan describing how BLM intends to bring the facility or facilities into compliance before Bordo Atravesado horses are transported there."	All horses removed from the Bordo Atravesado HMA will be transported to the Pauls Valley, OK Off-Range Corral (ORC) facility. The Comprehensive Animal Welfare Program (CAWP) inspection team has not yet completed an assessment of the Pauls Valley ORC but is scheduled to conduct an assessment at the facility, on November 8, 2022.
9	American Wild Horse Campaign	Interest Group	ePlanning 8-26-22	"Even though the BLM dismissed gathering to high AML from further analysis, the BLM's consideration of this alternative did not consider its use in combination with a comprehensive PZP program. Thus, the BLM must further analyze an alternative to manage wild horses in the Bordo Atravesado HMA at least at a level just below the high AML of 60 wild horses rather than reducing the low AML of 40 wild horses when a PZP program is used in the HMA."	Under this Alternative, a gather would be conducted to remove enough wild horses to achieve the upper range of the AML. This Alternative was dismissed from detailed study because AML would be exceeded by the next foaling season following gather resulting in the need to conduct another gather within one year. This would result in increased stress to individual wild horses and the herd and resource damage due to wild horse overpopulation in the interim, as the upper level of the AML established for the HMA represents the maximum population for which TNEB would be maintained. This Alternative is not consistent with the WFRHBA, which upon determination excess wild horses and burros are present requires their immediate removal (EA page 10).
10	American Wild Horse Campaign	Interest Group	ePlanning 8-26-22	"… AWHC strongly encourages BLM to pursue amendments to the Proposed Action to allow for a high	Same as above, response to comment #9

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				AML target population and implementation of a robust PZP/PZP-22 fertility control program, including a field darting component."	
11	The Cloud Foundation	Interest Group	Email 8-29-22	The EA fails to take a hard look at a reasonable alternative that: • reduces livestock grazing • increases AML for wild horses • utilizes only the well-established PZP fertility control for population growth suppression	Refer to comment response #1
12	American Wild Horse Campaign	Interest Group	ePlanning 8-26-22	"Removal to low AML should be reserved for specifically outlined emergency situations, to be analyzed in the final EA. If removal to low AML is retained in the final EA, it is essential for BLM to further analyze the following: ● Impacts of drastic reduction of population size on population growth rate. ● Impacts of drastic population reduction on genetic health of the populations within the HMA. ● Economic and welfare concerns related to increasing the off-range holding population of wild horses."	The BLM is not required, nor would it be appropriate, 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 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, the BLM was encouraged to consider the historical and present connections between HMAs. The BLM is not legally obligated to maintain a particular number of animals in any given herd, nor should a given herd be considered as a truly isolated population, given that there can be additional introductions of wild horses from other herds to augment genetic diversity and reduce risks of inbreeding. While genetic data would be collected to

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					monitor genetic diversity, there is currently no evidence to indicate that the Bordo Atravesado wild horses would suffer reduced genetic diversity if managed at the established AML range. Comments regarding the annual costs of administering the Bureau-wide wild horse program including off-range facilities, large gathers, federal tax collection, or cost effectiveness of program components or individual budget expenditures are outside the scope of this EA. Cost data was not developed for this EA since it is not part of the mandates under the Wild Horse and Burro Act and has no bearing on the action alternatives. These costs are not the basis for making a reasoned choice between alternatives given the Secretary's statutory responsibilities under the Wild Horse and Burro Act and Congressional appropriations for managing wild horse and wild burro populations on public lands.
13	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"BLM has not made a proper determination that there are excess horses or that action is necessary to remove them as required by the WFHBA and its own guidance documents. Instead, BLM bases the proposed action on an outdated AML. In the EA, BLM fails to consider what qualifies as a self-sustaining, healthy population of wild horses	Multiple use allocations between livestock, wild horses and wildlife are at the land-use planning level. This comment is therefore outside the scope of the wild horse gather EA and does not provide specific information to assist the BLM in refining its analysis in the EA.

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				and how its proposed action would impact the health and sustainability of wild horses. BLM also fails to adequately analyze any plans or alternatives that protect the wild horses in the Bordo Atravesado HMA."	
14	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"BLM presents no evidence demonstrating that the previously established AML is still valid or appropriate." "BLM is also relying on an outdated AML without making any effort to reassess the current validity of the AML before authorizing the removal of wild horses. In fact, BLM did not even provide information on how the AML was established."	Refer to comment response #15
15	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"Friends of Animals requests a copy of the document establishing the AML be made available to the public and that BLM extend the comment period for 30 days after such documents is made available. The BLM's failure to provide this information inhibits the publics' ability to make informed comments and contradicts the informed decision making mandated by NEPA. To the extent that BLM looks at more	Thank you for your comment. The Interior Board of Land Appeals has held that an HMAP is not a prerequisite to BLM conducting a gather operation (Animal Protection Institute of America, 109 IBLA 112, 127 (1989)), so long as the record otherwise substantiates compliance with the WFRHBA. Based on all available information, BLM has determined under the WFRHBA that excess wild horses are present and that a gather for removal of excess animals and application of population control measures is necessary to achieve a thriving natural ecological balance.

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				recent monitoring reports, it fails to distinguish the impacts of wild horses from other uses, such as current and historical cattle grazing. Without this information, BLM cannot determine if there is an overpopulation of wild horses that needs to be removed."	A copy of the Herd Management Plan is available for review at the BLM Socorro Field Office public room during business hours.
16	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"BLM's refusal to even consider in detail an alternative that re-evaluates the AML is thus arbitrary and capricious, and inconsistent with the RMP and WFRHBA."	Multiple use allocations between livestock, wild horses and wildlife are at the land-use planning level. This comment is therefore outside the scope of the wild horse gather EA and does not provide specific information to assist the BLM in refining its analysis in the EA.
17	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to conduct any analysis of the current "Allowable" Management Level (AML) in light of the fact that wild horses are (a) thriving in the HMA, (b) grazing livestock continues within the HMA and (c) the Proposed Action is in violation of existing laws and regulations that protect wild horses on these public lands. AML must be in conformance with the 1971 Wild Free-Roaming Horses and Burros Act. The majority of AUMs or forage allocation within the HMA must be "principally but not necessarily exclusively to wild horses and	The reduction of AUMs was not analyzed in the EA because it would not be in conformance with the Socorro Resource Management Plan. Any decision to change AML values for the HMA is outside the scope of this decision. It is also inconsistent with the Wild Free-Roaming Horses and Burros Act of 1971, which directs the Secretary to immediately remove excess wild horses when a determination is made that such removal is necessary. Furthermore, livestock grazing can only be reduced or eliminated if BLM follows regulations at 43 CFR § 4100. The BLM is mandated to manage for a thriving natural ecological balance and protect the range from deterioration while preserving multiple use relationships such as livestock grazing. The removal or reduction of livestock would not address resource concerns in the HMA that have been

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				burros" as outlined in the 1971 WHA."	directly linked to the current overpopulation of wild horses, including in areas that are not being grazed by livestock.
18	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to consider utilizing Adaptive Management to adjust the AML through an LUP amendment. BLM Adaptive Management document states, "The RMP will be implemented using adaptive management processes. Under adaptive management, decisions, plans and proposed activities are treated as working hypotheses rather than final solutions to management of resources and uses. For the purposes of this plan, adaptive management represents a process that tests, evaluates and adjusts the assumptions, objectives, actions, and subsequent on-the ground results from the implementation of RMP decisions."	Beyond the scope of this EA
19	Adams, Tammi	Individual	Eplanning 8-19-22	"… the agency does not define an AML at all in this EA, only stating, "The current population is 4.3 times above the upper limit of AML."	AML is defined under Alternative A (Proposed Action) of the EA on page 14.
20	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA must analyze the facts that AUMs continue to be permitted and utilized by livestock within the HMA, and in conformance with WHA which	The reduction of AUMs was not analyzed in the EA because it would not be in conformance with the Socorro Resource Management Plan. Any decision to change AML values for the HMA is outside the scope of

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				requires the HMA is to be managed principally for wild horses. AML should be increased and the majority of the current population should be accommodated and humanely managed with PZP or PZP-22."	this decision. It is also inconsistent with the Wild Free-Roaming Horses and Burros Act of 1971, which directs the Secretary to immediately remove excess wild horses when a determination is made that such removal is necessary. Furthermore, livestock grazing can only be reduced or eliminated if BLM follows regulations at 43 CFR § 4100. The BLM is mandated to manage for a thriving natural ecological balance and protect the range from deterioration while preserving multiple use relationships such as livestock grazing. The removal or reduction of livestock would not address resource concerns in the HMA that have been directly linked to the current overpopulation of wild horses, including in areas that are not being grazed by livestock.
21	Adams, Tammi	Individual	Eplanning 8-19-22	"While burros are not stated to be included in this gather and fertility control EA for the Bordo Atravesado HMA, Presidential orders state that AMLs must be reviewed with new information, including climate change. BLM presents no data in this EA in response to this Presidential order. It is reasonable for the agency to provide new AML information for wild horses and burros in this EA that include climate change…"	Climate change is not an issue related to the need for implementation of Alternative A (Proposed Action), which would remove wild horses from the Bordo Atravesado HMA, and limit their population growth rates with fertility control. While Alternative A (Proposed Action) to gather wild horses may involve some future contribution of GHGs, these contributions would not have a noticeable or measurable effect, independently or cumulatively, on a phenomenon occurring at the global scale believed to be due to more than a century of human activities.
22	Odowd, Patience WHOA	WHOA	Email 8-29-22	"re-look at BLM's management practices in light of climate change,	Refer to comment response to #21

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				and snow drought, caused by cattle. "	
23	Odowd, Patience WHOA	WHOA	Email 8-29-22	"There is nothing in this EA that deals with BLM's duty to its Mission statement or its duty to protect our public lands and resources from climate change." "Stocking levels of cattle should be looked at give our issues with climate change, the annual crops, tilled, grown and irrigated for their use when they are not on public lands and then the manure and Green House Gasses they produce when both on and off our public lands…"	Refer to comment response to #21
24	Oregon Wild Horse Organization	Interest Group	ePlanning 8-27-22	"Additionally on the bottom of the list (Attachment 3) we provided a list of 30 references that we do not even find referenced in the actual EA."	Correction made. Took out unused references. A copy of literature cited in the EA is available for review at the BLM Socorro Field Office public room during business hours. The Socorro Field Office is the administrative unit where this decision is being considered. Due to copyright laws and licensing agreements the agency does not have to authority to reproduce on the internet, or to freely release, the full text of all the literature cited in the document. But the BLM is in compliance with NEPA policy in that all the literature that contributed to the analysis is clearly cited in the EA and appendices and is available for public review at the appropriate BLM field office.

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25	Ford, Laurie	Individual	Email 8-28-22	"Recently captured wild horses, generally mares, in very thin condition may have difficulty transitioning to feed. (DOI-BLM-NM-A020-2022-0014-EA pg. 16) When did this take place? Why did this take place? How many were captured? Were these numbers included in any of the calculations made in the PEA? Where were these horses sent? There is no information in the PEA or on any BLM website regarding the recent removal of these horses. This statement alone calls for DOI-BLM-NM-A020-2022-0014-EA to be rewritten and resubmitted to the public for comment."	Correction has been made to the EA. The original text was just an inadvertent poor word choice. No horses have been captured from the Bordo Atravesado HMA since 2013 approved gather.
26	American Wild Horse Campaign	Interest Group	ePlanning 8-26-22	"Lastly, the EA contemplates a management action that was not included in the proposed action and therefore should not be authorized here for failure to provide public notice. On page 14, the EA states that the population target "could increase to mid-range AML with the addition of some geldings," however, neither the Proposed Action nor either of the Alternatives incorporated surgical sterilization in their management plans, nor did	Thank You for the comment. Correction made; no gelding will occur or will be analyzed in this EA.

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				they incorporate the release of sterilized horses or managing the Bordo Atravesado herd as partially non-reproducing. EA at 14. It would be inappropriate to utilize gelding as a management tool in this HMA because it was not included in the EA. AWHC has addressed the issue of gelding in its comments on the North Lander Wild Horse Gather Environmental Assessment ("EA"), (DOI-BLM-WY-R050-2021- 0037-EA) and incorporates those comments by reference herein.	
27	Oregon Wild Horse Organization	Interest Group	ePlanning 8-27-22	"No cost analysis of these 3 alternatives is included, nor are any of the others that were dismissed, such as on range management with PZP darting."	Cost data was not developed for this EA since it is not part of the mandates under the Wild Horse and Burro Act and has no bearing on the action alternatives. These costs are not the basis for making a reasoned choice between alternatives given the Secretary's statutory responsibilities under the Wild Horse and Burro Act and Congressional appropriations for managing wild horse and wild burro populations on public lands.
28	Borkowski, Carolyn	Individual	ePlanning 8-26-22	"The term humane is used frequently in this proposal but never defined." "…So please define humane. In which document is that definition found? And is that document available to all stakeholders?	Humane treatment is defined in the federal regulations that govern the BLM's application of the Wild and Free-Roaming Horses and Burros Act (as amended) in 43 C.F.R. § 4700.0–5(e): "Humane treatment means handling compatible with animal husbandry practices accepted in the veterinary community, without causing

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					unnecessary stress or suffering to a wild horse or burro."
29	Oregon Wild Horse Organization	Interest Group	ePlanning 8-27-22	"Note- this assessment was also not provided on the ePlanning site but rather was hidden from the public…"	Your comment was submitted on time through the ePlanning website. Thank You.
30	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to provide or consider data that refutes the long-standing and widely-accepted understanding that natural adult sex ratio for wild equids naturally favor females."	The EA includes a discussion and analysis of sex ratio manipulation and its potential effects. Clearly, the use of the word 'manipulation' includes the connotation that such actions may change the sex ratio that is present in a given herd without such human intervention.
31	Kiipper, Barbara	Individual	ePlanning 8-24-22	What's wrong with proven PZP?	Thank you for your comment. The potential effects of PZP vaccines and GonaCon-Equine vaccine are analyzed in the EA and appendices; both are consistent with humane care of wild horses
32	Hubbard, Beth	Individual	ePlanning 8-26-22	" There is too little data on its efficacy and safety.. It is known that it destroys normal hormone production in the pituitary gland and destroys the ovaries which is essential for natural wild behaviors."	Thank you for your comment. The potential effects of PZP vaccines and GonaCon-Equine vaccine are analyzed in the EA and appendices; both are consistent with humane care of wild horses. The EA includes discussion and acknowledgement of the known potential for either type of fertility control vaccine to change hormonal conditions in treated mares. Whether multiple doses of PZP vaccines and GonaCon vaccine cause a mare to not have any more foals in her lifetime depends on the duration of immunological effect, and the lifespan of the mare. Long-lasting contraceptive effects have the advantage of reducing herd growth rates, but the EA has analyzed and confirmed that use of such contraceptives will not prevent there from

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					being horse herds at levels that are at or above low AML, under the preferred alternative.
33	Borkowski, Carolyn	Individual	ePlanning 8-26-22	"…the EA states "Herds selected for fertility control vaccine use should have annual growth rates over 5%, have a herd size over 50 animals." Your proposal to reduce this herd to 40 does not meet this criteria."	A herd can have a 5% annual growth rate, even if the starting herd size is 40 animals. In that example, the herd would grow from 40 in one year to 42 in the following year.
34	Borkowski, Carolyn	Individual	ePlanning 8-26-22	"BLM states in the EA "If some fraction of mares treated with GonaCon-Equine were to become sterile, though, that result would be consistent with text of the WFRHBA of 1971, as amended, which allows for sterilization to achieve population goals." What exactly is the fraction of mares you ARE willing to permanently sterilize? And in which planning documents do you have the plans for permanent sterilization?"	As described in the EA the BLM will engage in monitoring to assess the herd's age and sex structure, herd size, and habitat conditions. I.e., "Multiple gathers may occur within a ten-year time frame that begins after the initial gather to achieve and maintain wild horse and burro populations within AML." …" Monitoring of rangeland forage condition and utilization, water availability, aerial population surveys and animal health would continue." "Estimation of population size and growth rates (in most cases, using aerial surveys) should be conducted periodically after treatments."
35	Borkowski, Carolyn	Individual	ePlanning 8-26-22	"GonaCon is experimental in nature and therefore the impacts cannot be properly analyzed in the EA because they are unknown. Sterilizing a significant portion of the remaining post-roundup herd would have a serious impact, goes against public sentiment and would require an EIS to be done."	GonaCon-Equine is not an experimental vaccine. Its use is regulated and approved for use by the EPA, as described in the EA. The EA includes a literature review on effects of GonaCon-Equine.

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36	Borkowski, Carolyn	Individual	ePlanning 8-26-22	[CHRONIC ABSCESSES AND LESIONS] "The one study done on horses that you cited (Curtis et al. 2008) appears to have been dismissed, ignored or overlooked even though it "found persistent granulomas at GonaCon-KHL injection sites three years after injection, and reduced ovary weights in treated females."	The EA includes a fuller discussion of potential injection site reactions than the commenter implies. Other studies are cited in the EA (i.e., Roelle and Ransom 2009, Bechert et al. 2013, French et al. 2017, Baker et al. 2018), as part of a larger discussion on the topic.
37	Borkowski, Carolyn	Individual	ePlanning 8-26-22	[CHRONIC ABSCESSES AND LESIONS] "Also clearly dismissed, ignored, or overlooked are additional studies such as the ones below done on equines. "...approximately 72% of treated mares (21/29) displayed a visible reaction at the site of Injection after a single vaccination with GonaCon-Equine (S1 Photo). A single mare developed a draining abscess after the initial vaccination. These lesions were persistent over multiple years. At the time of the 2013 roundup and revaccination, 81% (21/26) of vaccinated mares continued to have palpable swelling at the original site of vaccine injection. "Like initial vaccination reactions, during the first-year post-revaccination, approximately 50%	The EA includes a fuller discussion of potential injection site reactions than the commenter implies. Other studies are cited in the EA (i.e., Roelle and Ransom 2009, Bechert et al. 2013, French et al. 2017, Baker et al. 2018), as part of a larger discussion on the topic.

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				(13/26) of mares continued to show swelling on the left hip at the site of the 2009 injection and 50% developed a reaction on the right hip at the site of revaccination in 2013. Two of these new reactions were draining abscesses. Yet again, injection site reactions were persistent with approximately half of the mares with swellings at one or both injection sites, 3 years after revaccination. " (Baker, D.L., et al. 2018)	
38	Borkowski, Carolyn	Individual	ePlanning 8-26-22	[CHRONIC ABSCESSES AND LESIONS] "Also clearly dismissed, ignored, or overlooked are additional studies such as the ones below done on equines. "GonaCon products are classified by US EPA as restricted-use pesticides. GonaCon has caused injection-site and lymph node reactions, which include abscesses, nodules, swelling and stiffness from the water-in-oil emulsions containing mycobacteria such as AdjuVac" (Gionfriddo et al. 2011).	The EA includes a fuller discussion of potential effects of GonaCon-Equine than the commenter implies. Many studies are cited in the EA, as part of a larger discussion on the topic, including Gionfriddo et al. (2011).
39	Borkowski, Carolyn	Individual	ePlanning 8-26-22	"The BLM proposed usage of a GnRH vaccine has potential genetic and health side effects since it is an	The EA includes analysis that acknowledges this possible effect of immunocontraceptive vaccines ("Even with repeated booster treatments of the

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				immunocontraceptive. The 2013 NAS report states, “Methods that are not considered permanent may not be 100- percent reversible in all animals. Even if a contraceptive, such as an implant, is removed or its effect wears off (in the case of an injectable contraceptive), other factors may slow or even prevent complete restoration of fertility.”	vaccines, it is expected that most mares would eventually return to fertility, though some individual mares treated repeatedly may remain infertile.”).
40	Borkowski, Carolyn	Individual	ePlanning 8-26-22	[SIDE EFFECTS ON OTHER ORGANS] “As noted in this EA, the research done by Kirkpatrick on other organs found serious concerns - yet again it seems to be overlooked, dismissed, and ignored by the BLM.” “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	Kirkpatrick et al. (2011) raised those concerns based on studies of GnRH agonists, which operate differently than GnRH vaccines. As noted, lower in the same paragraph, the National Academies of Sciences downplayed these potential risks (“…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”).

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				could inhibit physiological processes in those organ systems."	
41	Borkowski, Carolyn	Individual	ePlanning 8-26-22	[USE OF GONACON ON MALES] " In the EA you state: "Administration of fertility control vaccines (i.e. PZP vaccines, GonaCon-Equine or newly developed vaccine formulations) to released females." Then, we the public, can be assured that you are not going to use GonaCon on males, correct? But if you plan on using GonaCon on males, then what research has been done to study the health impacts on male equines?"	GonaCon-Equine will not be used on male horses under this analysis or decision.
42	Borkowski, Carolyn	Individual	ePlanning 8-26-22	[CONCERNS WITH THE SOCIAL & BEHAVIORAL IMPACT FROM FERTILITY CONTROL METHODS] "The following are additional well-documented studies of the social impacts that result from fertility control methods (GonaCon and PZP) that appear to have been dismissed in your decision-making process." "It is possible that long-term absence of foals could influence social behavior on a longitudinal scale, but additional studies are needed to investigate such phenomena on an	The EA includes extensive discussion on the effects of various contraceptive methods on wild horses. The reduced relative fraction of foals in the herd is the obvious, and intended, effect of fertility control. As noted, I the text, "Contraception may change a herd's age structure, with a relative increase in the fraction of older animals in the herd (NPS 2008)."

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				appropriate time scale." (Baker, D.L., et al. 2018)	
43	Borkowski, Carolyn	Individual	ePlanning 8-26-22	[CONCERNS WITH THE SOCIAL & BEHAVIORAL IMPACT FROM FERTILITY CONTROL METHODS] "The following are additional well-documented studies of the social impacts that result from fertility control methods (GonaCon and PZP) that appear to have been dismissed in your decision-making process." "My research has shown that contracepted mares are less loyal to the band stallion; they change social groups more often, particularly during the non-breeding season. In addition, contracepted mares extend reproductive cycling into the non-breeding season." Dr. Cassandra M V Nuñez Cassandra Nunez Ph.D. found a: 1. loss of wild horse genetic lines, 2. social disturbances in family bands, 3. and other adverse effects (aborted foals, etc) with GonaCon use over time. She affirmed that nonsurgical sterilization of mares is experimental and extreme, and therefore an	Dr. Nuñez made extensive studies of the contraceptive and behavioral effects of horses treated with PZP vaccine, not GonaCon-Equine vaccine. The effects she documented are fully discussed in the EA in the context of effects of PZP vaccines.

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				irresponsible option. (nrem.iastate.edu/people/cassandra-m-nuñez)"	
44	Borkowski, Carolyn	Individual	ePlanning 8-26-22	[CONCERNS WITH THE SOCIAL & BEHAVIORAL IMPACT FROM FERTILITY CONTROL METHODS] "The following are additional well-documented studies of the social impacts that result from fertility control methods (GonaCon and PZP) that appear to have been dismissed in your decision-making process." "Feral horses (Equus caballus) have a complex social structure, the stability of which is important to their overall health. Behavioral and demographic research has shown that decreases in group (or band) stability reduce female fitness, but the potential effects on the physiological stress response have not been demonstrated. To fully understand how band stability affects group-member fitness, we need to understand not only behavioral and demographic, but also physiological consequences of decreases to that stability. We studied group changes in feral mares (an activity that induces instability, including both	The study noted by the commenter are included in the review of potential effects of fertility control vaccines, that is already included in the EA.

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				male and female aggression) on Shackleford Banks, NC. We found that mares in the midst of changing groups exhibit increased fecal cortisol levels. In addition, mares making more group transfers show higher levels of cortisol two weeks post-behavior. These results offer insights into how social instability is integrated into an animal's physiological phenotype. In addition, our results have important implications for feral horse management. On Shackleford Banks, mares contracepted with porcine zona pellucida (PZP) make approximately 10 times as many group changes as do untreated mares. Such animals may therefore be at higher risk of chronic stress. These results support the growing consensus that links between behavior and physiological stress must be taken into account when managing for healthy, functional populations. (Nuñez, C.M.V., J.S. Adelman, J. Smith*, L.R. Gesquiere, and D.I. Rubenstein. 2014)"	

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45	Borkowski, Carolyn	Individual	ePlanning 8-26-22	[CONCERNS WITH THE SOCIAL & BEHAVIORAL IMPACT FROM FERTILITY CONTROL METHODS] "The following are additional well-documented studies of the social impacts that result from fertility control methods (GonaCon and PZP) that appear to have been dismissed in your decision-making process." "However, research on Shackleford Banks, North Carolina, USA and on 3 western populations located in Little Brook Cliff s (Grand Junction, Colorado, USA), McCollough Peaks (east of Cody, Wyoming, USA), and the Pryor Mountains (Lovell, Wyoming, USA) has revealed behavioral and physiological side effects of long-term PZP use. When compared to untreated mares (those that have never received treatment), treated mares demonstrated decreased fidelity to the band stallion, increased and prolonged reproductive behavior, and an increased likelihood of extending reproductive cycling into the nonbreeding season. These effects were more pronounced in animals receiving more total and/or	The study noted by the commenter are included in the review of potential effects of fertility control vaccines, that is already included in the EA.

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				consecutive contraception treatments and can persist even after several years of treatment cessation. Finally, new data indicate that these changes to previously treated mares can affect the behavior and stress physiology of their band stallions, demonstrating the potential for the contraception of individuals to have population-level effects. These results are important to consider if we are to achieve both the effective management of feral horse populations in addition to the maintenance of their overall health and well-being." (Nuñez, C.M.V. 2018)"	
46	Borkowski, Carolyn	Individual	ePlanning 8-26-22	[CONCERNS WITH THE SOCIAL & BEHAVIORAL IMPACT FROM FERTILITY CONTROL METHODS] "The following are additional well-documented studies of the social impacts that result from fertility control methods (GonaCon and PZP) that appear to have been dismissed in your decision-making process." "Based on the assumed mechanism of action of GnRH vaccine, we posited that inoculation would	The study noted by the commenter are included in the review of potential effects of fertility control vaccines, that is already included in the EA.

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				suppress reproductive behaviors in treated females compared to controls and that the sudden decrease in density and social perturbation caused by population reduction would measurably influence social behaviors of all horses. (Behavior of feral horses in response to culling and GnRH immunocontraception" (2014) Jason I.Ransoma, Jenny G.Powers, Heidi M.Garbec, Michael W.Oehler Sr. Terry M.Nettc, Dan L.Bakerc)"	
47	Borkowski, Carolyn	Individual	ePlanning 8-26-22	[CONCERNS WITH THE SOCIAL & BEHAVIORAL IMPACT FROM FERTILITY CONTROL METHODS] "The following are additional well-documented studies of the social impacts that result from fertility control methods (GonaCon and PZP) that appear to have been dismissed in your decision-making process." "On Shackleford Banks, North Carolina, USA, treated mares have exhibited cycling during the non-breeding season and demonstrated decreased fidelity to the band stallion, but PZP's long-term effects on mare physiology and behavior remain largely unexplored. (Nuñez,	The study noted by the commenter are included in the review of potential effects of fertility control vaccines, that is already included in the EA.

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				C.M.V., J.S. Adelman, H.A. Carr*, C.M. Alvarez*, D.I. Rubenstein. 2017)"	
48	Heckert, Jannett	Individual	ePlanning 8-25-22	"There is no data that shows that Gonacon is reversible after 2 or more applications." "The EA must acknowledge that two applications of Gonacon are likely to cause permanent sterilization. The herds do not reproduce & will are zeroed out over time. Negative impacts that result from sex ratio skewing must be addressed."	The potential effects of PZP vaccines and GonaCon-Equine vaccine are analyzed in the EA and appendices; both are consistent with humane care of wild horses. Whether multiple doses of PZP vaccines and GonaCon vaccine cause a mare to not have any more foals in her lifetime depends on the duration of immunological effect, and the lifespan of the mare. Long-lasting contraceptive effects have the advantage of reducing herd growth rates, but the EA has analyzed and confirmed that use of such contraceptives will not prevent there from being horse herds at levels that will persist at or above low AML, under the preferred alternative
49	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"EA does not take a hard look at the impacts injecting fertility control drugs and returning to the HMA periodically to repeat these actions."	Thank you for your comment. The potential effects of PZP vaccines and GonaCon-Equine vaccine are analyzed in the EA and appendices. The effects analyzed included physiological and behavioral impacts, along with potential known effects on band structure (i.e., possibly higher rates of mares moving between social bands, after use of PZP vaccine).
50	Sheppard, Kim	Individual	Email 8-28-22	"If no horses were removed and all were left, Native PZP on the very young mares under four years of age and older mares (that have been in a state of pregnancy and lactation and contributed foals to the herd for many years) would be a safer	Fertility control only was one of the Alternatives considered but dismissed from detailed analysis.

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				alternative when compared to removal."	
51	Ford, Laurie	Individual	Email 8-28-22	"…while the BLM continues to study the use and impact of new fertility control vaccines another aspect of history seems to be overlooked – that herd genetics have already been affected by low herd numbers and the reintroduction of outside horses diluting the unique characteristics and bloodlines of the original herds."	The comment is based on an unsupported assumption that there was an original source population to the Bordo Atravesado herd that was genetically unique. The EA refers to available results of genetic monitoring from 2012; the herd did not include unique genetic markers at that time.
52	Ford, Laurie	Individual	Email 8-28-22	"The PEA fails to add any detail as to the number of mares they are considering treating and releasing back onto the range during the prosed gather. This information must be provided to aid in commenting."	The exact numbers of animals that would be gathered, removed, treated, or returned to the range without treatment will depend on specific herd size estimates and results of monitoring over the course of Alternative A (Proposed Action).
53	American Wild Horse Campaign	Interest Group	ePlanning 8-26-22	"Not yet explicitly contemplated in the Proposed Action is the notion that the BLM should initiate field darting in the same year that the agency applies the PZP-22 to captured and released mares. It is possible that, depending on the capture rate, the quantity of PZP-22 treated mares, as a percentage of the population's breeding-aged mares, is insufficient to achieve a significant reduction in population growth rate. If this is the case, field	The comment appears to suggest that animals be captured, treated, and released, with no removals included in the action. Fertility control only was one of the Alternatives considered but dismissed from detailed analysis.

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				darting can increase the percentage of treated mares to achieve on-range management goals."	
54	American Wild Horse Campaign	Interest Group	ePlanning 8-26-22	"Additionally, the final EA should contemplate the administration of fertility control vaccines before AML is reached. For example, the Cedar Mountain Herd Management Area Population Control Plan authorized BLM to "apply PGS vaccines . . . prior to achieving AML if gather success, holding capacity limitations, population growth rates, other national gather priorities, or other circumstances prevent the BLM from achieving AML during the initial gather operations." Bureau of Land Management, DOI-BLM-UT-W010-2022-0005-EA, Cedar Mountain Herd Management Area Population Control Plan 13 (August 2022). Administering fertility control before AML is achieved can significantly reduce the number of horses removed in future gathers …"	The EA states that all mares selected for release would be applied a fertility control (vaccine). See pg. 3, Alternative A (Proposed Action)
55	American Wild Horse Campaign	Interest Group	ePlanning 8-26-22	"Thus, field darting must be adequately incorporated into the population modeling in the final EA. Doing so will show a marked decrease in the population growth	The EA acknowledged that, "Once the population is at AML and population growth seems to be stabilized, BLM could use population planning software…"

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				rate of the herd. Removals to high AML or just below high AML, along with stabilized population growth, can allow BLM to adequately achieve its on-range management goals without the cyclic removals suggested by the modeling or the suggested need to target low AML."	
56	Falk, Rebecca	Individual	ePlanning 8-24-22	"As far as fertility control use Pzp vs gonacon. After two applications studies have shown gonacon will make the mare sterole and take away natural behaviors."	Thank you for your comment. The potential effects of PZP vaccines and GonaCon-Equine vaccine are analyzed in the EA and appendices; both are consistent with humane care of wild horses. Whether multiple doses of PZP vaccines and GonaCon vaccine cause a mare to not have any more foals in her lifetime depends on the duration of immunological effect, and the lifespan of the mare. Long-lasting contraceptive effects have the advantage of reducing herd growth rates, but the EA has analyzed and confirmed that use of such contraceptives will not prevent there from being horse herds at levels that are at or above low AML, under the preferred alternative. The behavioral effects of GonaCon are addressed in appendix E. Studies that have assessed behaviors of GonaCon-treated mares (Gray 2009, Ransom et al. 2014, Baker et al. 2018) did not find any evidence of those mares displaying unnatural behaviors.
57	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to consider the NAS recommendation regarding Gonacon."	The EA includes extensive reference to the NAS (2013) report and associated consideration of GonaCon effects. Those are addressed in detail in the EA, but a general reflection of why the NAS recommended

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					GonaCon as one of the three most promising methods at that time is, "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."
58	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA acknowledges, "Although the exact timing for the return to fertility in mares boosted more than once with GonaCon-Equine has not been quantified." Yet, the Proposed Action includes repeated applications of Gonacon without acknowledging the likelihood of permanent sterilization after just 2 or more applications. The EA fails to provide any data that shows that reapplication is safe – the reason the BLM does not provide such data is because it does not exist."	Thank you for your comment. The potential effects of PZP vaccines and GonaCon-Equine vaccine are analyzed in the EA and appendices; both are consistent with humane care of wild horses. The Ea acknowledges that some animals treated with multiple doses of PZP vaccine or GonaCon vaccine may remain infertile. Whether multiple doses of PZP vaccines and GonaCon vaccine cause a mare to not have any more foals in her lifetime depends on the duration of immunological effect, and the lifespan of the mare. Long-lasting contraceptive effects have the advantage of reducing herd growth rates, but the EA has analyzed and confirmed that use of such contraceptives will not prevent there from being horse herds at levels that persist at or above low AML, under the preferred alternative.
59	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to adequately analyze the effects of Gonacon which effectively destroys the ovary and/or ovary function. The intention of Gonacon is to shrink the ovaries and effectively destroy them. The scientific data demonstrates that	The EA includes a review of available scientific literature and acknowledges that there can be physiological and behavioral effects of PZP vaccines and GonaCon vaccine. That review includes citation of studies that have found reduced ovary size and/ or function in mares treated with PZP vaccines or with GonaCon vaccine.

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				Gonacon will negatively impact wild horses – both physiologically and psychologically."	
60	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to provide scientific data that supports Gonacon does not destroy natural "wild" horse behaviors as the NAS recommended is needed prior to implementation on the range. Merely claiming that "free-ranging" behaviors are maintained are not the "wild" behaviors that differentiate wild horses from their domestic cousins."	Please see Appendix E, SOPs for GonaCon-Equine Vaccine Treatments (pages 4 – 5) and Effects of Fertility Control Vaccines and Sex Ratio Manipulations (pages 10 – 29), which address numerous protocols, studies, effects and impact of GonaCon.
61	The Cloud Foundation	Interest Group	Email 8-29-22	"There is data that suggeststhat Gonacon is likely a permanent sterilant after just two applications; BLM-sponsored research showed that after just two injections of Gonacon 75% of treated mares were sterilized for at least 10 years. Unfortunately, BLM shutdown this research before Gonacon's permanent sterilization could be documented by the researcher. Clearly, additional years of observation are needed to ascertain what percentage of these mares can return to fertility. The data to date remains incomplete. However, based on available data in situ decisions	The commenter overstates the duration of effect from the BLM-sponsored work, which is described in Baker et al (2018; cited in the EA). That study documented about 75% or more of mares had nt returned to fertility after 3 years, after 2 doses of GonaCon. Further information since that publication suggests that a moderate number of mares remain infertile for at least a few more years after that, but no data have been reported to the BLM from later than 2020. The BLM is not withholding any results from being submitted in a peer-reviewed publication. Those data have not yet been published, but Dr. Baker has communicated his intention to submit them for publication this year (D. Baker, personal communication to the BLM).

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				involving Gonacon must be based on the existing science which suggests Gonacon is not reversible after just two injections. BLM has this data available because the agency paid Dr. Baker for this research. This data must be disclosed in the final EA…"	
62	The Cloud Foundation	Interest Group	Email 8-29-22	"Adopt a policy to prioritize protecting the natural wild behaviors of wild horses in all management actions which would eliminate the use of Gonacon and surgical sterilization;.."	Thank you for your opinion.
63	Adams, Tammi	Individual	ePlanning 8-19-22	"…the least invasive fertility control methods should be employed such as darting and only utilizing vaccine protocols proven reversible (PZP native annually). Furthermore, it is reasonable for BLM to allocate and exclusively utilize reversible fertility control protocol methods (PZP) for less than 4 years within generated HMAP EAs for the Bordo Atravesado HMA while taking into account foaling season."	Currently, the main population growth suppression methods used would be PZP and GonaCon due to availability, cost and effectiveness. BLM has not specified one specific method to maintain flexibility in implementing best management practices should new information regarding these methods become available during the 10-year plan.
64	Odowd, Patience WHOA	WHOA	Email 8-29-22	"There are feasible methodologies of PZP on range darting or native predator or used together which would naturally or more naturally	BLM does not plan to use field-darting as the main delivery system for PZP or GonaCon because only a low percentage of mares can be darted in these HMAs given the size and remote-ness of this Complex. This method could be used as a supplementary delivery

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				allow families to stay together, and live out their lives on the range:" "It is clear that only PZP should be considered by darting on-range without identification with enough data through time."	system. Also, field darting only shifts cost from holding to the field. Cost of damage to range lands from over populations contain much higher cost then holding of wild horses.
65	Odowd, Patience WHOA	WHOA	Email 8-29-22	""The use of fertility control methods 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." Really? Where is the data showing that this field office has utilized fertility control?	The quoted text from the Introduction / Background section of the EA is a general statement of expected results of the use of fertility control. The EA includes an extensive review of fertility control expected and possible effects, including reference to peer-reviewed population models.
67	Odowd, Patience WHOA	WHOA	Email 8-29-22	12) There is no clear mention of how or if the wild horses will receive contraception ON THE RANGE or if expensive round ups will be utilized to vaccinate wild horses at facilities.	Alternative A (Proposed Action) includes bait and water trapping.
68	American Wild Horse Campaign	Interest Group	ePlanning 8-2622	"the final EA should contemplate the administration of fertility control vaccines before AML is reached. Administering fertility control before AML is achieved can significantly reduce the number of horses removed in future gathers, saving horses from entering the off-range holding system and saving the	Fertility control only was one of the Alternatives considered but dismissed from detailed analysis.

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				agency the expense of their care there."	
69	Mabry, Kate	Individual	ePlanning 8-27-22	"…demand a veterinarian be onsite during any roundups/removals, not just on call. "	A veterinarian cannot always be onsite due to the nature of the opportunistic bait trapping method of gathering. SOPs will be followed.
70	American Wild Horse Campaign	Interest Group	ePlanning 8-26-22	"To avoid unnecessary risk, foaling season should still be avoided. Thus, the final EA should state clearly what time of year trapping would occur; currently, on page 7, the EA states that "trapping will take place in late fall and will continue until the majority of horses are caught or until it is not feasible to continue" whereas on page 15 the EA states that "trapping could occur at any time of the year and would extend until the target number of animals are removed . . . ." Id. at 7, 15 (emphasis added)."	Foaling season occurs year-round on the Bordo Atravesado HMA, though the peak expected foaling season is in spring. Correction made trapping will begin in late fall and will continue as opportunity arises.
71	The Cloud Foundation	Interest Group	Email 8-29-22	"Implement video recording of all roundup actions (on helicopters, trap sites, temporary holding)."	The placement of public/media cameras or recording equipment on trap sites, and temporary holding facilities are prohibited.
72	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"BLM claims in the EA that "Even though the herd is geographically isolated from other BLM-managed wild horse herds, history, context and periodic introductions mean that wild horses that live in the Bordo Atravesado HMA herd are not a truly	The geographic placement of Bordo Atravesado HMA is not the only determining factor to genetic diversity or genetic interchange with other herds. The EA includes a discussion of genetic considerations. As stated in the EA, it is not expected that genetic health would be impacted by the action alternatives. If genetic diversity monitoring reveals concerns about levels of genetic

	Sender Name	Organization	Comment Form / Date Received	Comment	BLM Response
				isolated population." However, this statement contradicts the evidence BLM has about the Bordo Atravesado HMA, which does not regularly intermix with any other herds"	diversity in the herd, additional fertile animals can be periodically introduced to ensure adequate levels of observed heterozygosity are maintained. In their 2013 report to the BLM, the National Academies of Sciences advocated for BLM to manage herds in the context of metapopulations of interacting herds across multiple HMAs. The wild horses in Bordo Atravesado HMA are descendants of domestic animals from mixed breeds and do not represent a unique genetic stock (Cothran 2013). 4700 Wild Horses and Burros Management Handbook, Section 4.4.6.4, Management Actions: "If the recommended minimum wild horses herd size cannot be maintained due to habitat limitations (e.g., insufficient forage, water, cover, and/or space) or other resource management considerations (e.g., T&E species), a number of options may be considered as part of an appropriate site-specific NEPA analysis to mitigate genetic concerns: • Maximize the number of breeding age wild horses (6- 10 years) within the herd. • Adjust the sex ratio in favor of males to increase the number of harems and effective breeding males. • Introduce 1-2 young mares every generation (about 10 years), from other herds living in similar environments. If wild horse herd size in small, isolated HMAs is so low that mitigation is not feasible, consideration should be given to managing the HMA for nonreproducing wild horses or to removing the area's designation as an HMA through LUP.

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73	Borkowski, Carolyn	Individual	ePlanning 8-26-22	"…you will make the argument for metapopulation management from the 2013 NAS Report, yet ignore the recommendation from your own equine geneticist, Dr. Gus Cothran, regarding the need for a total HMA population size of 150-200 animals in the herd to maintain genetic viability. And completely ignore the WFRHBA mandate regarding self-sustaining herds and self-reproducing herds."	As determined by the Resource Management Plan for the Socorro Field Office, the Bordo Atravesado HMA does not have the natural resources available to support more horses than the high end of AML, along with other multiple uses. The BLM does not need to manage this herd as if it were an endemic population of a rare species, without genetic connections to other populations.
74	Borkowski, Carolyn	Individual	ePlanning 8-26-22	"This EA has failed to consider the grave consequences to the loss of genetic viability to this herd by dismissing Dr. Cothran's warning that adding a few horses from other herds does not prevent inbreeding in small herds."	The BLM's considerations about genetic diversity maintenance in the EA are informed by Dr. Cothran's analysis of samples from this EA (Cothran (2013), the NAS report (2013), and other cited studies noted in the EA (i.e., Wright 1931, Mills and Allendorf 1996, BLM 2010).
75	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"Moreover, the genetic report from samples taken a decade ago recommended continued genetic monitoring. However, BLM failed to conduct the requiring monitoring. The current genetic health of the herd should be monitored and disclosed to the public in a NEPA analysis before BLM approves any action authorizing the harassment or removal of wild horse."	Thank you for your comment. Results from the most recent genetic diversity analysis by Dr. Cothran were already described in the EA. Also, results from Fst analyses that were included in the National Academies of Sciences 2013 report, which pointed to Bordo Atravesado horses being highly related to a large number of other herds, were also in the EA. The Cothran report is now also included as an appendix. Alternative A (Proposed Action) includes continued genetic monitoring, based on hair follicle samples from captured animals.

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76	Sheppard, Kim	Individual	Email 8-28-22	"Leaving so few horses according to a low AML of wild equines allowed in the area arguably will not allow for genetic viability that would be present with more animals to naturally interbreed amongst a larger herd." "The interbreeding of a smaller number of equines could result in possible line breeding and genetic anomalies (that could affect health/hardiness)within the herd of the smaller number of animals left with each season of new foals."	Genetic diversity monitoring is included in Alternative A (Proposed Action).
77	Ford, Laurie	Individual	Email 8-28-22	"In 1980 the AML of 32 horses was achieved in the Bordo Atravesado HMA, but the dangerously low number affected the genetic variation of the herd making it necessary to introduce 13 new horses in 1992 and 2 stallions in 1997 and 1998. According to Gus Cothran, a leader in the field of equine population genetics, a population of 50 to 150 is needed to maintain a viable breeding herd, and that herds like the Bordo Atravesado were at critical levels endangering future genetic viability. If the BLM pursues the current AML of 40	Thank you for your comment. AML for this herd was determined through land use planning process, and changes to the AML are outside the scope of this decision. In the EA section on Genetic Diversity, the BLM explains that horses in the Bordo Atravesado HMA are not a genetically isolated population. Consistent with recommendations from the National Academies of Sciences, they should be considered part of a larger metapopulation. The BLM noted evidence of the high level of genetic relatedness of these horses to other managed herds. Alternative A (Proposed Action) includes use of genetic diversity monitoring and possible introduction of additional fertile animals, if necessary.

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				history could very well repeat itself to insure the survival of the herd"	
78	American Wild Horse Campaign	Interest Group	ePlanning 8-26-22	"According to the EA, this herd's genetics were last tested in 2013, despite recommendations that this herd have continued genetic monitoring. EA at 13. The National Academies of Sciences report recommended the collection of genetic samples from each HMA at least once every 5 years. NAS Report at 161. Regardless, removal down to low AML will significantly reduce the effective population size of the Bordo Atravesado herd, therefore decreasing BLM's ability to maintain or achieve adequate genetic diversity."	Genetic diversity monitoring is included in Alternative A (Proposed Action).
79	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to acknowledge that the 2013 Cothran report highlights that the genetic health of the herd has been put at risk since 1992 – and has been in "a slow decline for the past 20 years."	In the EA section on Genetic Diversity, the BLM explains that horses in the Bordo Atravesado HMA are not a genetically isolated population. Consistent with recommendations from the National Academies of Sciences, they should be considered part of a larger metapopulation. The BLM noted evidence of the high level of genetic relatedness of these horses to other managed herds. Alternative A (Proposed Action) includes use of genetic diversity monitoring and possible introduction of additional fertile animals, if necessary.

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80	Oregon Wild Horse Organization	Interest Group	ePlanning 8-27-22	"The March 2022 population noted in the EA shows a population of 230 wild horses within and outside the HMA. The proposed removal of 190 will bring the population down to 40. This is the low end of AML and is not sustainable. There needs to be at least 150 wild horses for genetic viability."	See previous comments on genetic diversity, monitoring, and maintenance of acceptable levels of heterozygosity through introduction of additional animals, if that is determined necessary by genetic diversity monitoring.
81	Odowd, Patience WHOA	WHOA	Email 8-29-22	1) Wild Horse Genetics	See previous response to comments #79 and #80
82	Odowd, Patience WHOA	WHOA	Email 8-29-22	"Moreover, if this herd was at a 20 to 25% reproduction rate, it would be at a much higher population than 218 unless the BLM has allowed people to shoot them. What kind of investigation has this office done to determine this? "This has resulted in the BLM shifting program emphasis beyond just establishing AML and conducting wild horse gathers to include a variety of management actions that further facilitate the achievement and maintenance of viable and stable wild horse populations and a "thriving natural ecological balance" (TNEB). Management actions resulting from a shifting program	The BLM is required by law to maintain a thriving natural ecological balance on the public lands. The BLM is also required to maintain self-supporting herds of wild horses, and Alternative A (Proposed Action) would ensure that. However, the BLM is not required by law to manage the herd in each HMA as if it was a genetically isolated, endemic population.

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				emphasis include increasing fertility control, adjusting sex ratio and collecting genetic baseline data to support genetic health assessments. ”Really? All I see is that you are throwing away 200 wild horses? **Where is the genetic data?”**	
83	Odowd, Patience WHOA	WHOA	Email 8-29-22	“This plan includes the long list of CAMP regulations regarding helicopter round ups which should not even be there so we are commenting knowing that this agency has included that so that if given the chance they may illegally move forward on illegal helicopter round ups.” “This plan is continuing to utilize illegal Helicopter round ups which are illegal beciase they are inhumane AND continue to do this without on board video camera as recommended by the BLM’s veterinary Teams who were to FINALLY evaluate these illegal round ups but were NOT even allowed to fly in one during a round up.”	Helicopter operations are not considered under this environmental assessment.
84	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	“BLM never determines what degradation is likely from wild horses as compared to other uses. Without this baseline information, the public	The EA does not “draw a single line between rangeland degradation and wild horse occupancy,” rather the BLM identifies multiple causal factors for sites not meeting rangeland health standards.

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				cannot meaningfully comment on, or compare, proposed alternatives."	However, this comment is outside the scope of analysis and purpose and need of this EA. This EA is not the appropriate mechanism to address other causal factors, rather the EA purpose and need is to maintain and achieve wild horse and burro AML so as to be able to achieve a thriving natural ecological balance. Wild horses can degrade the quality of limited water sources and behaviorally exclude ungulates and other native wildlife from these water sources. Even in areas with long histories of livestock grazing, once domestic livestock are removed, continued wild horse grazing may cause ongoing detrimental ecosystem effects. Plant communities can take several decades to recover from such impacts.
85	Odowd, Patience WHOA	WHOA	Email 8-29-22	"WHOA and CAES understands that the trend is to keep cattle on the range year round (after all the wild horses are gone) in order to have the cattle then justified to eat the invasive species in the warming winters when the inedible seeds are dropped off (cheat grass etc.). Given that this is the case, leaving a certain percent of cattle on the range year round should be looked at as a way to also keep water on the territories year round. This should be considered BEFORE unequally	Wild horses and burros are cecal digesters and are less selective in forage preference than other grazing ungulates (Beever 2003, Janis 1976, Hanley and Hanley 1982). Because of this, they consume 20-65% more forage that ruminants of equal body size (Beever 2003, Hanley 1982, Wagner 1983, Menard et al. 2002). Additionally, because equids possess a set of upper incisors whereas ruminants do not, they are able to destructively graze forages to the ground thus inhibiting the plants ability to recover (Beever 2003, Symanski 1994, Menard et al. 2002). Furthermore, Beever (2003) observed that horse trails were of greater number, length, and spatial extent than cattle. Finally, horses concentrate dung piles, as opposed to

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				causing the removal of all of our wild equines under the pretense of natural drought."	spreading them out over the landscape as the commenter has implied. Pellegrini (1979) found that horse dung piles can reach greater than 60 cm in height and more than 10 m^2 in extent.
86	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to adequately analyze the 1971 WHA mandates for the BLM management of wild horses/burros on public lands. Congressional Intent Is Clear: The Designated "Range" Is "Devoted Principally" for Wild Horse and Burro Use."	This alternative would not be in conformance with the Socorro Field Office RMP (2010), is contrary to the BLM's multiple -use mission as outlined in the Federal Land Policy and Management Act (1976), and also would be inconsistent with the Wild Horse and Burro Act (1971), which directs the Secretary to immediately remove excess wild horses and burros. Furthermore, it was Congress' intent to manage wild horses and burros as one of the many uses of the public lands, not a single use. Therefore, the BLM is required to manage wild horses and burros in a manner designed to achieve a thriving natural ecological balance and sustainability among wild horse and burro populations, wildlife, domestic livestock, vegetation and other uses: "The principal goal of this legislation is to provide for the protection of the animals from man and not the single use management of areas for the benefit of wild free -roaming horses and burros (emphasis added). It is the intent of the committee that the wild free -roaming horses and burros be specifically incorporated as a component of the multiple -use plans governing the use of the public lands" (Senate Conference Report 92-242). The "principally but not necessarily exclusively" language applies to specific Wild Horse Ranges, not to HMAs in general. The Code of Federal Regulations (43 CFR, Subpart 4710.3-2) states: "Herd management

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					areas may also be designated as wild horse or burro ranges to be managed principally, but not necessarily exclusively, for wild horse or burro herds." Due to high population growth since the last gather, wild horse numbers are significantly over the level at which a thriving natural ecological balance can be maintained and BLM has determined that removal of those excess animals to reach low AML is necessary, along with application of fertility controls to reduce the rate of future population growth. The Bordo Atravesado HMA has not been designated as a 'wild horse range.' That change would require a change to the land use planning, which is outside the scope of this decision.
87	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to disclose and consider the actual use of livestock for each of the past 10 years in the HMA and throughout the Field Office jurisdiction and consider the cumulative impact of the livestock practices – specifically livestock usage must be compared to AUMs allocated for wild horses. . This must be disclosed and considered because the National Environmental Policy Act (NEPA) requires the agency to consider the cumulative effect each decision has. If there are excessive	The EA follows the guidance provided in BLM IM No. 2019-004. This memorandum guides BLM offices to analyze various wild horse management actions to meet the Purpose of and Need for Action (EA, p. 3) and to analyze management actions over multiple years. The 10- year timeframe of this EA enables BLM to determine the effectiveness of Alternative A (Proposed Action) at successfully achieving and/or maintaining population levels within AML in the Bordo Atravesado HMA; a process at which the BLM is unlikely to be successful in a short time frame. Opportunistic bait trapping is not an organized gather event such as the helicopter drive-trap gathers which

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				numbers of AUMs utilized by livestock in and around the HMA, the EA must disclose this and provide a scientific rationale for the agency's failure to provide balance use of the resource. The EA cannot simply state that implementing an action outlined in a land use plan (LUP) is exempt from further analysis. LUPs only become effectuated through an EA when a Proposed Action is decided upon."	are more typically used in other HMAs to capture high numbers of horses in a short amount of time. Using opportunistic bait trapping as the primary method to gather is a longer duration process with multiple factors with which to acknowledge. Factors such as weather, water availability, forage availability, animal behavior, and the administration of fertility control can all increase the amount of time needed to reach AML. The trapping and fertility control treatment application process, along with concomitant monitoring as noted in the EA, will continue up to 10 years. This time frame allows for enough trapping and fertility control treatments to determine and ensure that the herd will be maintained within AML. If new information or circumstances arise during this 10-year period, the NEPA process would be used to identify if the analysis in this EA is still valid, or if supplemental or new NEPA analysis is required.
88	Borkowski, Carolyn	Individual	ePlanning 8-26-22	"In a recent ruling, it was determined that BLM does not have the authority to issue Gather EAs that are in effect for 10 years, (Friends of Animals v. Culvar, 2022), but must instead follow proper NEPA regulations and at a minimum do an EA for every gather you plan to do. This ruling also affirms that a 10-year plan eliminates the public's ability to due process in the government's	Refer to comment response #87

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				actions and management of wild horses for an unacceptably long period. Prevailing public preference must be considered as dictated by the National Resource Council, National Academy of Sciences and the White House Council on Environmental Quality. Despite the fact that you will claim that this proposal for a 10-year gather plan is consistent with other BLM gather decisions in multiple states - it must be conceded by the BLM that this new ruling must modify this EA for a single roundup event only." "This EA has not been revised to reflect the recent court case prohibiting 10 year Gather EAs."	
89	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"The EA also states that the proposed action would purportedly authorize BLM to continually roundup wild horses for ten years after the initial roundup. However, BLM cannot authorize continued removal and harassment of wild horses for several years into the future with a single decision."	Refer to comment response #87

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90	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"There is no authority for BLM to authorize removal and harassment in such a vast area for ten years, as it proposes to do in the EA at issue here. BLM does not have, and cannot have, information that removal is necessary for ten years. Range conditions, wild horse numbers, and the AML can change each year."	Refer to comment response #87
91	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"BLM cannot proceed with a roundup decision, especially one the purports to authorize the continued removal and harassment of wild horses for ten years, without first creating a herd management area plan."	Refer to comment response #87
92	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"BLM must issue a separate site-specific NEPA analysis for each roundup and does not have authority to issue one decision that covers multiple roundups over the course of ten years."	Refer to comment response #87
93	Burk, Joy	Individual	ePlanning 8-11-22	"I oppose the issuance of a 10-year decision because it side-steps the agency's requirement to review changing environmental conditions and new information. It also infringes upon the public's right to review and comment on related	Refer to comment response #87

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				government actions over the next 10 years."	
94	American Wild Horse Campaign	Interest Group	ePlanning 8-26-22	"… the EA does it indicate that it will take 10 years to achieve AML in this herd. In contrast, the EA argues that, based on prior experience, the agency could expect a capture rate as high as 93%. EA at 56. If the current population estimate of 230 is accurate, this capture rate would result in only 16 horses left uncaptured, far below low AML. Thus, a 10-year EA is inappropriate for this HMA. See Friends of Animals v. Culver, No. 19-cv-3506, 2022 WL 2315537 (D.D.C. June 28, 2022)."	The actual capture rate for bait / water trapping can vary widely, as a function of a large range of factors. As is made plain in the EA, the BLM would not reduce the herd size to levels lower than the low AML established for this HMA.
95	The Cloud Foundation	Interest Group	Email 8-29-22	"The Proposed Action includes authorization to allow the decision record to cover government actions however vaguely outlined in the EA through 2032. The EA fails to outline definitive, year-by-year plans, rather throwing in a menu-like approach without delineating out specific actions for each of the 10 years the Proposed Action purports to cover. This highlights the uncertainty of what actions may be taken, when, to how many horses, the outcome of those actions, and the	Refer to comment response #87

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				implementation of proposed new, unproven and controversial actions over a 10-year period."	
96	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to take into consideration a recent court ruling on implementing an EA for a 10-year period: "As to the second argument, however, the Court agrees that BLM's ten-year deadline exceeds its discretion, per statutory command, to 'immediately remove excess animals from the range so as to achieve appropriate management levels.'" Friends of Animals v. Culver, Civil Action No. 19-3506 (CKK) (2022)." "The Proposed Action should be amendment to eliminate the 10-year period and should only apply to the activities that would occur immediately within one to two years of the signed Decision Record."	
97	Oregon Wild Horse Organization	Interest Group	Email 8-27-22	"Secondly, we would like to point out that in light of the recent ruling on June 28, 2022, that a 10-year plan is a violation of current statutes. Friends of Animals v. Culver. "Particularly given BLM's concessions in its briefing, ten years in this instance simply cannot mean, as a	Refer to comment response #87

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				matter of the plain language of the WHBA, "immediately." As a ten-year "phased" plan exceeds, in this case, BLM's discretion under the WHBA, the Court remands the Decision to BLM for reconsideration." Friends of Animals v. Culver, Civil Action 19-3506 (CKK), 15 (D.D.C. Jun. 28, 2022) Based solely on this point the BLM should retract this EA. Though it's stated that livestock grazing within the Bordo Atravesado HMA is outside the scope of this EA, when a removal is caused by an abundance of grazing animals where one animal has principal use rights by law, and that right is affected by a another use it is definitely within the scope, since it is discussed throughout the entire EA it has been brought into the scope…"	
98	Adams, Tammi	Individual	ePlanning 8-19-22	"It is unreasonable for the agency to initiate a 10-year gather and PGS plan for the Bordo Atravesado HMA wild horses under a single EA. This and any 10-year plan is a direct violation of NEPA and First Amendment rights omitting "meaningful public involvement" in the agency decision-making process	Refer to comment response #87

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				for the Bordo Atravesado HMA/HA and all other wild horses and burros on public lands."	
99	Adams, Tammi	Individual	ePlanning 8-19-22	"Concerns are great that this 10-year plan could morph into utilization of motorized vehicles and helicopters for capturing wild horses and burros. The agency needs to clarify that only bait and water trapping will be utilized for any possible gather or PGS plans/operations on the Bordo Atravesado HMA if this 10-year gather and PGS EA is approved."	Refer to comment response #87
100	Odowd, Patience WHOA	WHOA	Email 8-29-22	"A ten-year plan is inappropriate and unlawful and at least in part the courts have ruled against this. " "10 YEAR PLAN not legal - the recent ruling on June 28, 2022, that a 10-year plan is a violation of current statutes. Friends of Animals v. Culver."	Refer to comment response #87
101	Hubbard, Beth	Individual	ePlanning 8-26-22	"We oppose the BLM 10-year Decision as it infringes on our right to address new information."	Refer to comment response #87
102	Adams, Tammi	Individual	ePlanning 8-19-22	"The agency provides no "current information" supporting a "determination" of excess wild horses or burros. "	The BLM conducts aerial population inventories according to policies and regulations as found in BLM Instruction Memorandum No. 2010-057: Wild Horse & Burro Population Inventory and Estimation. The number of flights depends on which inventory method is used. Usually only one flight occurs, but with the

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					mark-resight, second flights may occur. Ground truthing is used to verify marker animals (animals with distinct markings or colors), general locations of populations, and to direct where a flight should occur. Aerial surveys are a more accurate method to count horse herds in large areas than ground surveys. The simultaneous double-observer method used to survey horses has passed peer-review in scientific literature (Lubow and Ransom, 2016, Practical bias correction in aerial surveys of large mammals: validation of hybrid double observer with sightability method against known abundance of feral horse (Equus caballus) populations. PLoS ONE 11(5): e0154902.) doi:10.1371/journal.pone.0154902.). During surveys, crews make all efforts to avoid counting any group of horses twice, by taking photographs and noting coloration of individual horses as well as group composition of foals and adults; if there is any doubt about a group of horses having been seen before, BLM standard operating procedures call for these groups to be excluded from the population estimate. Indeed, aerial surveys tend to underestimate true wildlife abundance because a proportion of animals go unseen by observers (NAS 2013). Simultaneous double-observer analyses can account for some of those unseen animals, but even that method tends to underestimate actual abundance unless all sources of sighting heterogeneity are accounted for (Griffin et al. 2013. A hybrid double-

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					observer sightability model for aerial surveys. The Journal of Wildlife Management 77(8): 1532- 1544) The flight and gather data has continually shown that direct count flights undercount wild horses on the range. The Government Accountability Office (GAO) concluded through their review that "research and experience have shown that BLM's on -the -range population estimates are too low", and stated that "regardless of which method is used, counting wild horses and burros can be challenging, particularly when the animals are obscured by trees or when the rangeland is covered with snow" (GAO 09 -77). The BLM may employ both a direct count and a simultaneous double count method to determine the population of wild horses during helicopter inventory. During inventories the BLM maintains Best Management Practices to ensure the highest quality data and most accurate inventory. On most flights, three experienced BLM observers participate, in addition to the pilot, who is also very skilled at completing wild horse inventory. Inventory flights are conducted at low altitude (below 300' at times) and low speeds, with trained WHB Specialists and oftentimes Wildlife Biologists or other Resource Specialists. It is very easy to distinguish wild horses from livestock, and even more so from wildlife. The helicopter pilot records the location of the horses with an onboard GPS, which also records the flight path.

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					The flight area boundaries are also viewed by the pilot on the onboard computer screen to ensure the entire area is covered. The location of previously observed wild horses is also verified on the onboard computer screen if needed. BLM staff record wild horses on 1:100,000 maps, and the number and description of bands observed are recorded on data sheets. As the flights progress, natural landforms or barriers are used to ensure movement of wild horses doesn't occur between the areas as they are completed. Observers take great care to document characteristics of groups of horses encountered such as color, leg markings, face markings, and direction of travel, so as to decrease the change of counting any bands or horses twice.
103	Wright, Brenna	Individual	ePlanning 8-27-22	"There is no proof that the herd increased from 98 horses in 2020 to your proposed of numbers of 230 by just using a figure generated by your department of supposed percentage increase which would not even take into affect horses that may have died from old age or natural causes."	The March 2022 population size was estimated to be 230 (based on the direct count aerial survey) see Appendix F for double observer-based estimate.
104	Wright, Brenna	Individual	ePlanning 8-27-22	"You are using numbers that are 20 years old that have not been reviewed and updated. The herd numbers are population est : 1980 32 increased to 50 in 1989, 2009 71 - 2012 95- 202 98 So how in 2 years could it go to 230?"	Refer to comment response #103

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105	Ford, Laurie	Individual	Email 8-28-22	"Under BLM's online program data (www.blm.gov/programs/wild-horse-and-burro/) it is documented that in June, 2012, with an estimated population of 96 horses in the Bordo Atravasado HMA, 92 were captured of which 56 were removed and 36 stallions/geldings released indicating that almost every horse remaining on the range would have been a male. If half of the 40 which were not captured were female that would leave approximately 20 females – not all of breeding age – on the range. There is no information provided regarding the gelding of any of these stallions released. Even if the post gather population is correct at 46, we can justly assume the majority of the herd were males and less than 20 females."	Refer to comment response #103
106	Ford, Laurie	Individual	Email 8-28-22	"The current estimated population within and outside the Bordo Atravesado HMA for 2022 is 230 wild horses as of March 20, 2022. This estimate is based on an aerial survey using the simultaneous double-observer method. Current population estimates reflect the	Thank you for your comment. Typical levels of wild horse herd growth rates are noted in the EA, based on published literature from other herds (i.e., Ransom et al. 2016). The EA indicates that the herd has consistently been growing over time at high rates. Based on census data, population growth estimates at Bordo Atravesado are high, which is consistent with values from other herds. In May of 2016, the estimated

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				assumption that wild horse herds in this area increase 20-25% or more per year, which is consistent with the published rates (NAS 2013, Ransom et al. 2016). (DOI-BLM-NM-A020-2022-0014-EA pg. 1) Yet, on the same page of the PEA, the published growth rates were as follows: For example, it has been determined that wild horses are capable of increasing their numbers by 15% to 25% annually, resulting in the doubling of wild horse populations about every 4 years. (DOI-BLM-NM-A020-2022-0014-EA pg. 1) So, is it 15-25% or 20-25% and which rate was applied when determining the current Bordo Atravesado population and the numbers to be removed?"	number of horses in the herd associated with this HMA was 59, a number that had grown to 230 in 2022. There are always uncertainties in aerial survey, but those point estimates imply a 25.5% per year population growth rate, because 59 times 1.255 raised to the sixth power is 59*3.81=230. Therefore, the assumption of 20% per year growth rate used in the WinEquus model (Appendix C) is appropriate and, if anything, somewhat conservative.
107	Ford, Laurie	Individual	Email 8-28-22	"The PEA states some projected abundance value methods could lead to slight overestimates of true population size in certain circumstances when the information source is from a time period between September 1 and February 28. (DOI-BLM-NM-A020-2022-0014-EA Pg. 49)."	Refer to comment response #106 BLM has determined that rangeland conditions will continue to degrade and will be unable to recover if wild horse and populations are not managed and maintained within AML. The BLM will continue to monitor ecological health conditions within the Bordo Atravesado HMA and evaluate whether allotments are meeting rangeland health standards.

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				"The Bordo Atravesado aerial survey appears to have been conducted between March 1 and 20, 2022. – only days from the time period that could lead to overestimates stated above. The PEA must provide additional information regarding the aerial survey as to date, length, numbers observed and the formula used to determine those present but not seen. This is vital as the data from aerial surveys – already identified as being questionable - is used in conjunction with annual growth rate formulas – also identified as being questionable - to determine the final population numbers, number of horses to be removed and the number of mares to receive fertility control vaccines."	
108	Oregon Wild Horse Organization	Interest Group	ePlanning 8-27-22	"Current population estimates reflect the assumption that wild horse herds in this area increase 20-25% or more per year, which is consistent with the published rates (NAS 2013, Ransom et al. 2016)." (pg. 1) If an aerial survey was done, why are they estimating population based on annual population growth rates?"	Refer to comment response #106

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109	Ford, Laurie	Individual	Email 8-28-22	"In the PEA it is only stated The HMA was last gathered in May 2012. At that time, 94 wild horses were gathered, 54 removed, and 40 horses released back to the HMA. (DOI-BLM-NM-A020-2022-0014-EA pg. 12) with no additional information provided as to sexes released or fertility control vaccines administered."	The SFO released 20 mares and 20 studs back into the HMA with no fertility control administered.
110	Oregon Wild Horse Organization	Interest Group	ePlanning 8-27-22	"There is bias in this EA as well as conflict of interest. The Consultation and Coordination person is Diane DelCurto who is a grazing permittee. There is no person or group representing the wild horses, we believe that wild horse advocates should be included in the planning process prior to the scoping public comment period as stakeholders."	Thank You. Revised on EA page 26-27
111	Odowd, Patience WHOA	WHOA	Email 8-29-22	2) Wild Horse Weight and per animal forage consumption is just assumed to be 1 AUM and the horses weigh almost twice what they actually weigh.	Refer to comment response #85
112	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"if BLM is going to rely on mitigation measures, then it must include sufficient detail about how this will be implemented to constitute an enforceable commitment. The EA	Refer to comment response #156

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				merely includes vague language about what it may do if needed. It fails to provide any detail sufficient to constitute an enforceable commitment."	
113	The Cloud Foundation	Interest Group	Email 8-29-22	"consider accommodating the majority of the current wild horse population in conjunction with range improvements (such as fencing off sensitive areas, protecting riparian areas, etc.) and temporary or permanent reduction or elimination of livestock grazing pursuant to 43 C.F.R. 4710.5(a)." "The Proposed Action must be amended to maintain a population of at least 150-200 wild horses in order to address the decades-long mismanagement by BLM New Mexico." "…must provide scientific data that shows the removal of livestock could not achieve the same objective. It is legally established that the BLM has no authority to remove horses merely to achieve AML."	Refer to comment response #4, #121 & #163
114	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"BLM does not analyze grazing utilization and distribution, trends in ecological conditions, climate data, or any other evidence that	Refer to comment response #3, #121 & #163

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				deterioration from wild horses is occurring in the Bordo Atravesado HMA."	
115	Ford, Laurie	Individual	Email 8-28-22	"I am also requesting further data/information on topics relevant to the proposed gather that were omitted, further data/information on topics relevant to the proposed gather that were included but rendered incomplete, and further data/information needed to support statements made by the NM BLM throughout the PEA that played a role in the proposed action to be taken. The omission of this data/information has impacted my ability to comment on DOI-BLM-NM-A020-2022-0014-EA as a fully informed citizen and resident of New Mexico."	Refer to comment response #103
116	Ford, Laurie	Individual	Email 8-28-22	"The BLM Rangelands Administration Systems Report reflects the expiration date of the Bordo Atravesado grazing allotment #01254 permit was 6/1/2022 in an "improve category". This allotment information needs to be clarified and updated in the PEA as it encompasses the entire HMA."	The permit expiration date is correct. The base lease expired and has since reverted to the base property owner of record. Refer to comment response #163, #121 & #3

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117	Ford, Laurie	Individual	Email 8-28-22	"If there is any science-based data to support such a generalization made in the PEA it must be included so that the public can take it into consideration when commenting."	Refer to comment response #103
118	Ford, Laurie	Individual	Email 8-28-22	"The unreasonable lack of an HMAP for the Bordo Atravesado HMA – especially when one considers the BLM has only 2 HMAs within the state to manage with a population under approximately 400 - requires the agency's proposed EA should include, at minimum, all census data, seasonal use data, foaling season information, genetic data, Thriving Natural Ecological Balance (TNEB) data, and all data pertaining to wild horse use in, around, and through the project areas and throughout the neighboring HMAs prior to implementation of the proposed actions in this EA."	Refer to comment response #124
119	Ford, Laurie	Individual	Email 8-28-22	"Once again, The PEA must provide the public with the data from the 2022 aerial survey as this is the source from which the current abundance number is based upon and the determination of how many horses will be removed, returned	Refer to comment response #103

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				and treated with a fertility control vaccine. If the abundance number is even off by a small fraction, and a fertility control vaccine used that can render the few remaining mares sterile, the Bordo Atravesado HMA wild horse population could very well be be decimated. This is unacceptable."	
120	American Wild Horse Campaign	Interest Group	ePlanning 8-26-22	"the EA should provide the 2022 aerial survey report upon which the current estimated population is being based. The census concludes that the "current estimated population within and outside the Bordo Atravesado HMA for 2022 is 230 wild horses as of March 20, 2022." EA at 1. This population estimate is much larger than the 138-horse population estimate as of Mar. 1, 2022, and the public should be given the opportunity to view and comment on the aerial census to ensure that the process followed was scientifically sound. Bureau of Land Management, Herd Area and Herd Management Area Statistics: as of March 1, 2022."	Refer to comment response #103
121	The Cloud Foundation	Interest Group	Email 8-29-22	"The final EA must disclose the actual use of livestock-grazing AUMs	Thank you for your comment. The purpose and need for Alternative A (Proposed Action) are described in the

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				(by allotment) in the HMA for each of the past 10 years. Data for livestock grazing by pasture must also be provided. Rangeland health assessments that support continued livestock grazing in the HMA must also be provided. ” • “Disclose the actual use number of livestock for each of the past 10 years; the breed and weight of cows that graze in the HMA must be disclosed.” • “A list and map of all allotments within the HMA. Pastures within allotments should be disclosed on the map (including pasture fencing).” • Disclosure of any illegal livestock grazing in the HMA or surrounding area. • Rangeland health assessments (full assessments should be provided in the Appendix) conducted over the past 10 years for all areas within the original Herd Area – including pastures, allotments, etc. • Scientific data and criteria utilized to differentiate livestock usage impacts from wild horse impacts.	EA. BLM decisions about other land uses are outside the scope of this decision. The current overpopulation of wild horses, relative to available natural resources, is contributing to areas of heavy vegetation utilization, trailing and trampling damage and is preventing the BLM from managing for rangeland health and a thriving natural ecological balance and multiple-use relationships on the public lands in the area. Refer to comment response #84

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				• Maps that show all fencing in and around ALL the HMA. Maps must show how wild horses are able to fully utilize the HMA(s) when certain pastures are closed to livestock grazing must be provided; this includes notation on maps of where gates are located on the fencing. • Maps that show all water sources (noting the seasons of availability) in the HMA, with complete information about water that is made available to livestock but fenced off from horses or seasonal water sources including how they are regulated and the months of operation. • Disclose any federal government compensation for non-use of livestock in the HMA must be disclosed.	
122	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to distinguish between horse grazing and livestock grazing except to say that wild horses are on the range year-round whereas livestock is permitted to graze in the Herd Area from winter through the first two months of Spring – the most	Refer to comment response #84

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				sensitive growing season for rangeland health." "The EA fails to differentiate the grazing patterns and impacts of wild horses from livestock." "The EA fails to provide any specific information indicating the criteria and science utilized by the BLM to distinguish between the impacts of wild horses and livestock. If TNEB is BLM's objective and if, as the EA states, this range is not meeting rangeland health objectives, then in order for BLM to make a determination of excess wild horses – the agency must provide the data, science and analysis behind its decision to continue (or increase) the "actual use" livestock grazing (as requested above) while TNEB is threatened."	
123	Oregon Wild Horse Organization	Interest Group	ePplanning 8-27-22	"… the EA states that the AUM's for the affected area are set in the Socorro RMP. However the only place The Wild Horses are mentioned in the - "Management for wild horses in the planning area is set through the Bordo Atravesado Wild Horse Herd Management Plan." This plan is not included in the	Refer to comment response #124

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				relevant documents on the ePlanning site, nor can it be found online."	
124	Adams, Tammi	Individual	ePlanning 8-19-22	"… without an existing or current Herd Management Area Plan (HMAP) as mandated by law (43 CFR §4710.3-1) for the Bordo Atravesado Herd Management Area (HMA) there is no viable way to infer impact nor mitigate damages to wild horse and burro populations from BLM's proposed actions presented in this EA." "The unreasonable lack of an HMAP for the Bordo Atravesado HMA requires the agency's proposed EA should include, at minimum, all census data, seasonal use data, foaling season information, genetic data, past and current Thriving Natural Ecological Balance (TNEB) data, defining all present and forthcoming multiuses within the HMA, and all data pertaining to wild horse and burro use in, around, and through the project areas and throughout the neighboring HMAs prior to implementation of the proposed actions in this EA."	Thank you for your comment. The Interior Board of Land Appeals has held that an HMAP is not a prerequisite to BLM conducting a gather operation (Animal Protection Institute of America, 109 IBLA 112, 127 (1989)), so long as the record otherwise substantiates compliance with the WFRHBA. Based on all available information, BLM has determined under the WFRHBA that excess wild horses are present and that a gather for removal of excess animals and application of population control measures is necessary to achieve a thriving natural ecological balance. A copy of the Herd Management Plan is available for review at the BLM Socorro Field Office public room during business hours.

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125	Adams, Tammi	Individual	ePlanning 8-19-22	"BLM's statement of conformance with the RMP and the arbitrary omission of an up-to-date HMAP for the Bordo Atravesado HMA is unreasonable, out-of-date, and arbitrary."	Refer to comment response #15
126	Adams, Tammi	Individual	ePlanning 8-19-22	", no data is provided for public review in this EA regarding the "assumed" TNEB of the HMA rangeland."	Refer to comment response #84
127	Adams, Tammi	Individual	ePlanning 8-19-22	"Moreover, livestock grazing impact (83% of HMA public land allotted to livestock) data to TNEB must also be collected, analyzed, and data presented for public review prior to implementation of BLM Proposed Actions presented within this EA."	Refer to comment response #163
128	The Cloud Foundation	Interest Group	Email 8-29-22	"… the EA fails to outline the actual use of livestock AUMs within the HMA. Without consideration of alternative management actions (as outlined herein) on public lands, the BLM cannot claim that the removal of wild horses is needed to achieve the claimed goals as stated in the EA. "	Refer to comment response #163
129	Odowd, Patience WHOA	WHOA	Email 8-29-22	"There is as usual lip service about what is going to happen in the future, with no actual current data shared on actual counts, genetics,	Refer to comment response #84

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				cattle, differential analysis of impact of horse, cow, deer, elk, antelope etc."	
130	Odowd, Patience WHOA	WHOA	Email 8-29-22	""The current estimated population within and outside the Bordo Atravesado HMA for 2022 is 230 wild horses as of March 20, 2022. This estimate is based on an aerial survey using the simultaneous double-observer method. Current population estimates reflect the assumption that wild horse herds in this area increase 20-25% or more per year, which is consistent with the published rates (NAS 2013, Ransom et al. 2016). The current population is 4.3 times above the upper limit of AML." Let's see the data? What statistical method, and you assumed a 20 to 25% population increase to come up with your count? "	Refer to comment response #103 & #106
131	Borkowski, Carolyn	Individual	ePlanning 8-26-22	"…BLM should engage with the public in ways that allow public input to influence agency decisions, develop an iterative process between public deliberation and scientific discovery, and codesign the participatory process with representatives of the public."	Comment noted. Thank you.

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132	Oregon Wild Horse Organization	Interest Group	ePlanning 8-27-22	"So BLM in the grazing allotment assessment that determines the number of livestock and seasons of use for this allotment states that all rangeland health standards are met. And in the EA to justify a wild horse gather states that if No-Action is taken they would not be achieved, which makes the statement that they are not now being met. BLM cannot have it both ways. Either there is a problem or there is not…"	Refer to comment response #134 and #163
133	Borkowski, Carolyn	Individual	ePlanning 8-26-22	"While you claim that recent monitoring data shows degradation due to overgrazing which in turn necessitates the permanent removal of "excess" animals, where are the studies done to prove conclusively that it is the wild horses that are solely responsible for the damage - with zero impact from livestock, mule deer, and elk, whose diets overlap that of wild horses."	Refer to comment response #84
134	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"BLM should also take a hard look at the impacts of wild horses and correct the EA which erroneously attributes a disproportionate share of range deterioration to wild horses despite the evidence that cattle, who	The Interior Board of Land Appeals (IBLA) in Animal Protection Institute et. al., (118 IBLA 63, 75 (1991)) found that under the Wild Free-Roaming Horses and Burros Act of 1971 (Public Law 92-195) BLM is not required to wait until the range has sustained resource damage to reduce the size of the herd, instead proper range management dictates removal of "excess

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				far outnumber wild horses, are causing damage to the range."	animals" before range conditions deteriorate in order to preserve and maintain a thriving natural ecological balance and multiple-use relationship in that area (EA Pg. 3).
135	Ford, Laurie	Individual	Email 8-28-22	"The agency declares that wild horses alone are to blame for rangeland not meeting thriving natural ecological balance (TNEB) standards as defined under the Federal Land Policy and Management Act of 1976 (FLPMA, PL 94-579). However, no data is provided regarding the TNEB of the rangeland in this EA."	Refer to comment response #134
136	Oregon Wild Horse Organization	Interest Group	ePlanning 8-27-22	"BLM states (pg. 2) that "The Proposed Action is also consistent with the Wild Free-Roaming "Horses and Burros Act of 1971 (WFRHBA), which mandates the Bureau to "prevent the range from deterioration associated with overpopulation",..." This quote is nowhere in PL 92-195 (WFRHBA). What 16 USC §1333 (b)(2)(iv) actually states is to "protect" the land from deterioration associated with overpopulation.	Thank you for the comment. Correction made The WFRHBA, as amended by Congressional acts since 1971, does not require that ecological damage already has been caused by an overpopulation of wild horses for some of those animals to be found to be excess. The BLM WHB management handbook H-4700-1 (BLM 2010, section 4.3) specifies that: "The term 'excess animals' is defined as those animals which must be removed from an area in order to preserve and maintain a thriving natural ecological balance and multiple-use relationship in that area (16 USC § 1332(f)(2)). This definition underscores the need to remove excess animals before damage to the range begins to occur."

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137	Oregon Wild Horse Organization	Interest Group	ePlanning 8-27-22	"BLM does not have the authority to perform gathers as a preventative measure, especially when the Rangeland Health Assessment from approximately 2 weeks before this EA was published stated that all rangeland health standards are met."	Refer to comment response # 163
138	Oregon Wild Horse Organization	Interest Group	ePlanning 8-27-22	"This EA at pg. 2 states: "restore thriving natural ecological balance and prevent further degradation of rangeland resources from the current overpopulation of wild horses" - AML in and of itself does not prove overpopulation. As stated previously BLM has claimed in the Rangeland Health Assessment that this area as of July 31, 2022 met ALL rangeland Health Standards. So this statement is either in error or fraud…"	Refer to comment response # 163
139	Borkowski, Carolyn	Individual	ePlanning 8-26-22	"What scientific assessment have you completed that puts full responsibility for range degradation on the wild horses?"	Refer to comment response #134, #136, and #163
140	Hubbard, Beth	Individual	ePlanning 8-26-22	"Do not remove any wild horses from the area until livestock have been removed."	Eliminating or reducing grazing in order to shift forage use to wild horses would not be in conformance with the existing Land Use Plan and is contrary to the BLM's multiple-use mission as outlined in FLPMA and would be inconsistent with the WFRHBA and PRIA. It was

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					Congress' intent to manage wild horses and burros as one of the many uses of the public lands, not a single use. Therefore, the BLM is required to manage wild horses and burros in a manner designed to achieve a thriving natural ecological balance between wild horse and burro populations, wildlife, domestic livestock, vegetation and other uses.
141	Heckert, Jannett	Individual	ePlanning 8-25-22	"Alternative & Solution – Zero out the 227 cattle who can graze year-round on other BLM land. There are only two herd left in the area."	Refer to comment response #140
142	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"The EA fails to analyze an alternative in detail that includes reducing the number of cattle allowed to graze in the Bordo Atravesado HMA. This alternative would improve the condition of the range. The EA erroneously concludes that this would not be in conformance with the existing land use plan or does not achieve the purpose and need in the EA." "BLM failed to analyze any alternatives in detail that would eliminate cattle and sheep in the Bordo Atravesado HMA or even reduce the permitted use."	Refer to comment response #140
143	Best, Jennifer	Interest Group	ePlanning 8-26-22	"The proposed action, to remove wild horses while refusing to reduce forage for private companies	Refer to comment response #3

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	Friends of Animals			conflicts with the WFHBA, which states that the range should be principally devoted to wild horses."	
144	The Cloud Foundation	Interest Group	Email 8-29-22	"One alternative the EA fails to take a hard look at is the ability to reduce livestock grazing in order to manage wild horses at or near the current populations…"	Refer to comment response #3 & #163
145	Oregon Wild Horse Organization	Interest Group	ePlanning 8-27-22	"removal or decreases in livestock via AUM adjustments should be considered, and if the BLM can only do this in the RMP, then the RMP needs to be reviewed and amended before a gather plan of this great magnitude to this specific herd is undertaken."	Refer to comment response #163
146	Burk, Joy	Individual	ePlanning 8-11-22	"I am in favor of the No-Action Alternative with the following action items implemented: 1. Cancel the "draft" EA to revise the LUP for allocation of livestock forage to WHs and; 2. Change the boundaries of the HMA so the WHs are not within the livestock grazing allotment and; 3. Change the livestock grazing allotment so livestock does not encompass the whole HMA and; 4. Increase the AML for a viable, genetic, diverse herd by means of	Refer to comment response #163

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				using rational based data/decisions. BLM needs to determine how many WHs the range can support by thoroughly conducting rangeland condition reviews, instead of using the arbitrarily established low AML, and consider the revised allocation of the new HMA boundaries."	
147	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"BLM should consider reasonable alternatives to achieve a thriving natural ecological balance in the Bordo Atravesado HMA including adjusting the current AML, adjusting forage allocated to cattle, and allowing natural controls."	Refer to comment response #3
148	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"BLM should circulate an Environmental Impact Statement (EIS) or new Environmental Assessment (EA) that analyzes additional alternatives in detail, including adjusting the AMLs and reducing the forage allocated to cattle in order to create a thriving, natural ecological balance without the need to roundup wild horses and remove them from public lands."	As determined in the FONIS, none of the anticipated environmental effects are considered significant. As explained in 40 CFR 1508.13, Finding of No Significant Impact (FONSI) means a document by a Federal agency briefly presenting the reasons why an action, not otherwise excluded (§ 1508.4), will not have a significant effect on the human environment and for which an environmental impact statement therefore will not be prepared. The FONSI explains that "The Council on Environmental Quality's (CEQ) regulations provide that the significance of impacts must be determined in terms of both context and intensity (40 CFR. § 1508.27)."

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					Impacts were analyzed in the EA and are known—the action alternatives are not expected to be significant, involve unique or unknown risks, and are not highly controversial. BLM has not identified any significant impacts that would trigger the need for an EIS. Refer also to "significance" as described in BLM NEPA Handbook 1790-1.
149	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to take a hard look at 43 CFR 4700.06(b), given the proposal to remove wild horses to low AML while allowing livestock grazing to continue. While the BLM claims wild horses must be removed for TNEB, it is believed that the BLM continues to allow higher numbers of commercial livestock to graze the same area. If this is accurate, this is in direct conflict with governing statute which specifically states that horses "shall be considered comparable with other resource values in the formulation of land use plans." If the BLM's proposal to remove wild horses is implemented, the BLM will not be in conformance with this statute, because they are not treating wild horses in the HMA as "comparable" – or the same as – livestock that graze in the same area."	See response to comments #3 & #4

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150	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to provide any scientific data that shows the removal of livestock could not achieve the same objective. It is legally established that the BLM has no authority to remove horses merely to achieve AML."	Refer to comment response #3
151	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA is wrong when it states on page 9, "This alternative [Remove or Reduce Livestock Within the HMA] was not brought forward for analysis because it is inconsistent with the Socorro Field Office RMP, and the WFRHBA which directs the Secretary to immediately remove excess wild horses."	Refer to comment response #3
152	Ford, Laurie	Individual	Email 8-28-22	"BLM does not have the legal authority to regulate or manage mountain lion populations, and it is not clear whether there are any mountain lions in the Bordo Atravesado HMA that specialize on horse predation. Andreasen et al. (2021) concluded that "At landscape scales, cougar predation is unlikely to limit the growth of feral horse populations.". (DOI-BLM-NM-A020-2022-0014-EA pg 74) Both statements failed to include the entirety of the source's content they	Thank you for your comment. "BLM does not have the legal authority to regulate or manage mountain lion populations, and it is not clear whether there are any mountain lions in the Bordo Atravesado HMA that specialize on horse predation. Andreasen et al. (2021) concluded that "At landscape scales, cougar predation is unlikely to limit the growth of feral horse populations.". (DOI-BLM-NM-A020-2022-0014-EA pg 75) In regard to self-regulation, this is not a viable option for wild horses in the Bordo Atravesado HMA. First, the use of natural means to achieve a desirable AML has not been shown to be feasible in the past. Wild horses

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				are included in – distorting the facts - and are, therefore, misleading to the public who is attempting to comment on the PEA."	in the Bordo Atravesado HMA are not substantially regulated by predators or other natural factors. Survival rates for wild horses on western public lands are high. None of the significant natural predators from native ranges of the wild horses in Europe and Asia — wolves, brown bears, and possibly one or more of the larger cat species — exist on the wild horse ranges in the western United States (mountain lions take foals in a few herds, but predation contributes to population limitation in only a handful of herds). Moreover, wild horses are a long-lived species they do not self-regulate their population growth rate. Wild horse and burro numbers have increased an average of approximately 20-25 percent per year since the HMA was last gathered in 2013. Second, self-regulation is not viable because the HMA is extremely arid and easily damaged by overuse. If the wild horse population increased to the point that a lack of resource availability caused severe stress to the herds and the population to decrease through mortality, there would be widespread, irreparable damage to the rangelands along with major suffering for individual horses (affecting mares and foals most severely). These conditions would not be consistent with BLM's mandate to manage for a thriving natural ecological balance and would impede or preclude management of healthy wild horses and healthy rangelands into the future.

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					The NAS report (2013) concluded that the primary way that equid populations self-limit is through increased competition for forage at higher densities, which results in smaller quantities of forage available per animal, poorer body condition and decreased nasality and survival. It also concluded that the effect of this would be impacts to resource and herd health that are contrary to the BLM management objectives and statutory and regulatory mandates. This is not a viable alternative since it would result in a steady increase in the wild horse populations which would continue to exceed the carrying capacity of the range resulting in a catastrophic mortality of wild horses in and irreparable damage to rangeland resources.
153	Oregon Wild Horse Organization	Interest Group	ePlanning 8-27-22	"Higher rates of cougar predation within the HMA are an additional consideration that needs to be addressed. These are natural predators of wild horses and burros. This EA claims, "Analysis in NEPA documents prepared by USDA has shown that these impacts are short term and in the long term there is no impact on population viability."	Thank you for your comment. "BLM does not have the legal authority to regulate or manage mountain lion populations, and it is not clear whether there are any mountain lions in the Bordo Atravesado HMA that specialize on horse predation. Andreasen et al. (2021) concluded that "At landscape scales, cougar predation is unlikely to limit the growth of feral horse populations.". (DOI-BLM-NM-A020-2022-0014-EA pg 75) Refer to comment response #152
154	Odowd, Patience WHOA	WHOA	Email 8-29-22	"These are key parts of socio-economics and social justice not mentioned in this EA. Any actual Cost analysis of various relevant ON RANGE contraceptive options as well	Comments regarding the annual costs of administering the Bureau-wide wild horse program including off-range facilities, large gathers, federal tax collection, or cost effectiveness of program components or individual budget expenditures are outside the scope of this EA.

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				as the impacts to the horse industry of glutting the market with horses at less than kill buyer prices."	In determining which issues must be addressed in an environmental analysis, the CEQ Regulations state that NEPA documents "… must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail" (40 CFR 1500.1(b)). While many issues may arise during scoping, not all of the issues raised warrant analysis in the EA. Issues were analyzed if: 1) an analysis of the issue is necessary to make a reasoned choice between alternatives, or 2) if the issue is associated with a significant direct, indirect, or cumulative impact, or where analysis is necessary to determine the significance of the impacts. Cost data was not developed for this EA since it is not part of the mandates under the Wild Horse and Burro Act and has no bearing on the action alternatives. These costs are not the basis for making a reasoned choice between alternatives given the Secretary's statutory responsibilities under the Wild Horse and Burro Act and Congressional appropriations for managing wild horse and wild burro populations on public lands.
155	The Cloud Foundation	Interest Group	Email 8-29-22	"The EA fails to consider the interests of those who cherish the opportunity to observe, photograph, and otherwise enjoy wild horses and their natural behaviors … these are the very horses which Congress	Alternative A (Proposed Action) would bring the populations of wild horses and burros to within the established AML ranges; the BLM would not remove all horses or burros from the HMA. For this reason, the opportunities for wild horse viewing would continue.

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				declared to be "national esthetic treasure[s]" when it enacted the Wild Free-Roaming Horses and Burros Act of 1971." "Recreational users of these public lands, specifically those who enjoy wild horse photography and viewing, will not be negatively impacted by the Proposed Action."	
156	Odowd, Patience WHOA	WHOA	Email 8-29-22	"The fact that this SOP is requiring identification per the outdated IM of any treated animal thereby requires round ups."	BLM is mandated to follow guidance in National WH &B IMs and SOPs. Fertility control practices are also included in the BLM WHB management handbook (2010). Effects of Alternative A (Proposed Action) and B are analyzed in the EA.
157	Odowd, Patience WHOA	WHOA	Email 8-29-22	"THERE IS NO COMPARATIVE FEASIBILITY ANALYSIS for this SOP which requires never ending round ups and re-round-ups for even those sterilized?" "The INSTRUCTION MEMORANDUM IS OUT OF DATE - BLM IM 2009-090"	Refer to comment response #156
158	Odowd, Patience WHOA	WHOA	Email 8-29-22	"SPAY and Neuter: This statement of comparison of horses and donkeys is without basis: "While most studies reviewed here refer to horses, burros are extremely similar in terms of physiology, such that expected effects are comparable, except where differences between the species are noted." This is arbitrary	The EA does not analyze neutering or spaying as an action alternative. This EA does not address burro management. However, the National Academies of Sciences (2013) stated that, "Nevertheless, given similarities in reproductive physiology, the efficacy and safety of

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				and capricious. This is unscientific. Donkeys are much smaller than horses and when they have this invasive surgery with the huge arm repeatedly into their smaller cavities, what is deadly for a horse is even more deadly for a burro and this was shown by Dr. Pielstick's DVM experiments in AZ where most of the burros died from this cruel invasive procedure."	methods could be expected to be generally similar in the two species."
159	Borkowski, Carolyn	Individual	ePlanning 8-26-22	What standard(s) are you held to guarantee their safe and humane treatment? The CAWP addresses, to some degree, humane treatment for roundups, transportation, and warehousing, but not for fertility control."	Appendix D: Standard Operating Procedures for Fertility Control Vaccines page 67, describes the procedures.
160	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"BLM fails to acknowledge or discuss the harmful consequences of the stress, specifically the stress caused removing horses from the familiar range and placing them in captivity, in concentrated animals feedlots that have inhumane conditions and inadequate space and shelter for the wild horses."	The BLM is committed to the humane handling of wild horses and burros. The BLM implements the most effective and humane methods in order to reduce stress and injury to wild horses and follows the Comprehensive Animal Welfare Program (CAWP) which provides standards for humane treatment of wild horses and burros for all gather operations. Potential effects of gathers and removal, and captivity, are addressed in the EA.
161	Ford, Laurie	Individual	Email 8-28-22	"Moreover, livestock impact data (83% of HMA public land allotted to livestock) to the TNEB must also be	The EA does not propose to change the public viewing or study of wild horses in the Bordo Atravesado HMA. The BLM encourages the viewing and enjoyment of

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				collected, analyzed, and data presented prior to any BLM proposed actions presented within this EA. In order for the agency to state wild horses are the only species to affect TNEB in this HMA, livestock, extraction, public encroachment, and recreation impacts must also be studied and recognized in the Bordo Atravesado HMA. Only then will the multiple-use mandate be reasonably reflected in TNEB impacts."	America's wild horses. The BLM acknowledges that wild horse viewing is a valid recreational use in the Bordo Atravesado HMA. Alternative A (Proposed Action) would bring the populations of wild horses to within the established AML range; the BLM would not remove all horses from the HMA. For this reason, the opportunities for wild horse viewing would continue.
162	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"BLM fails to consider that the proposed action places the health of the wild horses at risk. Not only did BLM fail to take a hard look at how the proposed action would impact the wild horses, but it also failed to disclose any enforceable plan to protect the health, viability, and sustainability of this wild horse population."	Refer to comment response #156
163	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"Nor does the EA provide an explanation of how BLM determined the impact of horses, as compared to other uses, on the condition of the range."	This comment is outside the scope of analysis and purpose and need of this EA. This EA is not the appropriate mechanism to address other causal factors, rather the EA purpose and need is to maintain and achieve wild horse AML so as to be able to achieve a thriving natural ecological balance.
164	Best, Jennifer	Interest Group	ePlanning 8-26-22	"BLM's failure to quantify how much other uses are contributing to range	Refer to comment response # 163

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	Friends of Animals			deterioration is a serious flaw particularly as more studies demonstrate that wild horses can have a positive impact on the range, and thus, BLM is likely erroneously attributing damage caused by other uses to wild horses.2"	Appendix D includes a literature that alludes to possible ecological benefits of wild horses.
165	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"…the EA does not indicate what portions of the range were monitored, trends in the range, or its current condition. Instead, BLM simply states that wild horses need to be removed to provide a thriving natural ecological balance without providing data to support its statements. BLM's failure to adequately monitor the range, along with its failure to distinguish the impact due to wild horses is inconsistent with the requirements of the WFHBA, the applicable land use plans, and its own guidance documents."	Refer to comment response # 163
166	Best, Jennifer Friends of Animals	Interest Group	ePlanning 8-26-22	"The EA provides an incomplete and misleading analysis of the impact of wild horses on the range and the No-Action alternative because it ignores scientific information about the positive impact of wild horses."	See response to comments #163 and #9

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				"…removing wild horses to artificially low numbers not only negatively impacts the individual horses and the genetic viability of the herd, but it is also short-sighted and ineffective because it prompts short term population growth."	
167	Burk, Joy	Individual	ePlanning 8-11-22	"There is no proof within the EA that land damage is caused by the WHs."	Refer to comment response # 163
168	Ford, Laurie	Individual	Email 8-28-22	"Considering the Bordo Atravesado HMA sits entirely within a livestock grazing allotment, it is reasonable for the agency to consider the impact from year-round livestock grazing for the failing TNEB criteria. Particularly considering wild horses have been on this HMA since 1950, and livestock grazing allotments have increased significantly since that Ume. It is the agency's obligation to provide documentation that a TNEB has not been met specifically due to wild horse populations prior to removal and fertility control implementation plans presented in this EA."	Refer to comment response # 163
169	Ford, Laurie	Individual	Email 8-28-22	"While DOI-BLM-NM-A020-2022-0014-EA presents multiple population modeling scenarios (ex: WinEquus in Appendix C) it fails to	AML in Bordo Atravesado HMA is 40-60 wild horses. AML was established in the Socorro Field Office RMP and Bordo Atravesado HMAP.

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				clarify to the public how the targeted AML for the Bordo Atravesado HMA was established. In fact, the agency does not define an AML at all in this EA, only stating, "The current population is 4.3 times above the upper limit of AML." Without an HMAP demonstrating how AML was determined, the agency has unreasonably presented an arbitrary AML without scientific, site-specific data analysis, and ignored NEPA requirements of meaningful public involvement in HMAP development. Without this pertinent data available for review the public is being denied the right to comment on the proposed gather accordingly."	
170	Adams, Tammi	Individual	ePlanning 8-19-22	"The agency presents multiple population modeling scenarios utilizing WinEquus in Appendix C, but fails to present to the public how the targeted AML for the Bordo Atravesado HMA was established."	Refer to comment response # 169.