# United States Department of the Interior
# Bureau of Land Management

## Environmental Assessment - Appendices

## DOI-BLM-CO-N050-2020-0056

## *Piceance-East Douglas Herd Management Area Gather and Fertility Control Plan*

**February 2021**

BLM


U.S. Department of the Interior
Bureau of Land Management
Northwest District
White River Field Office
220 East Market St
Meeker, CO 81641

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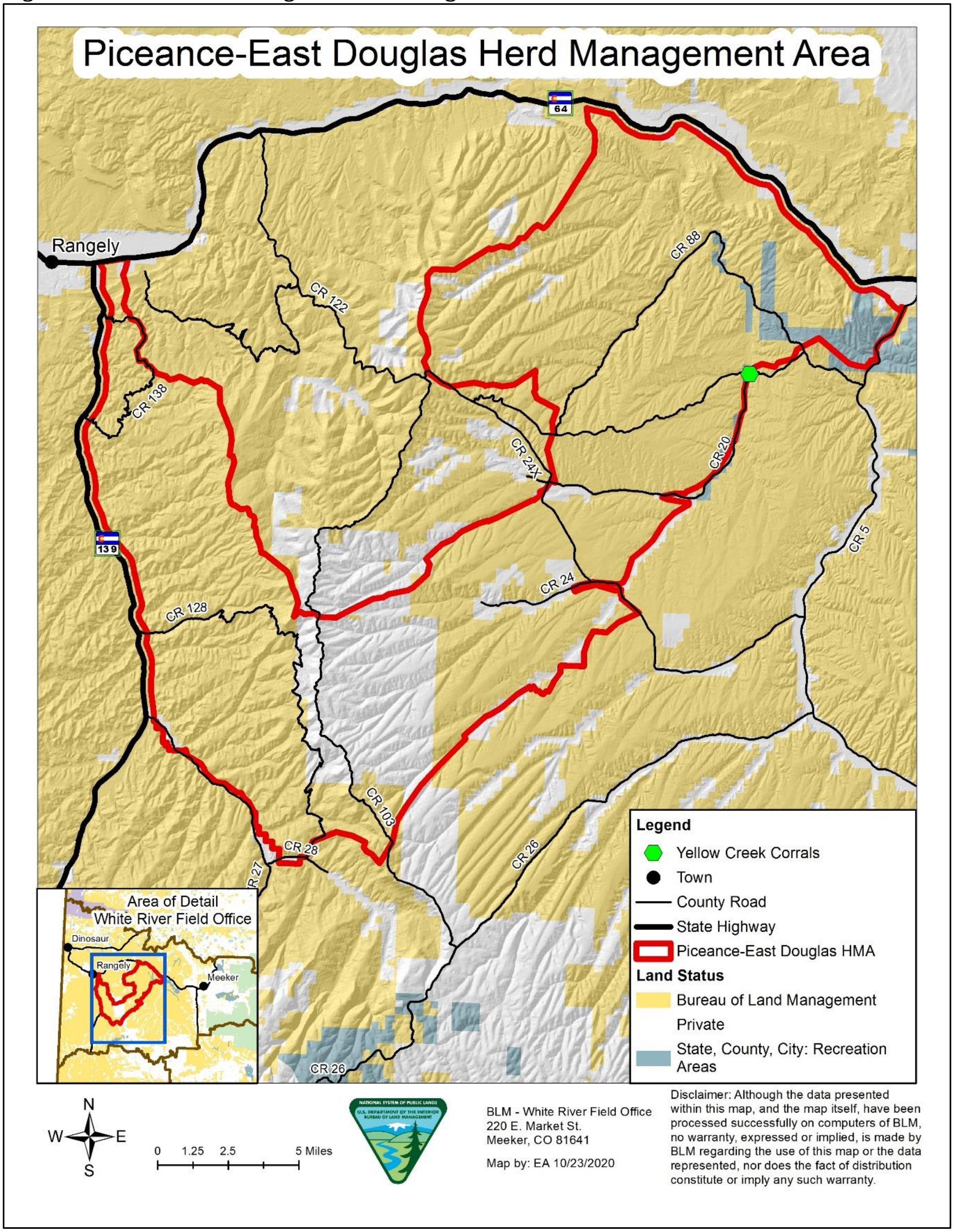
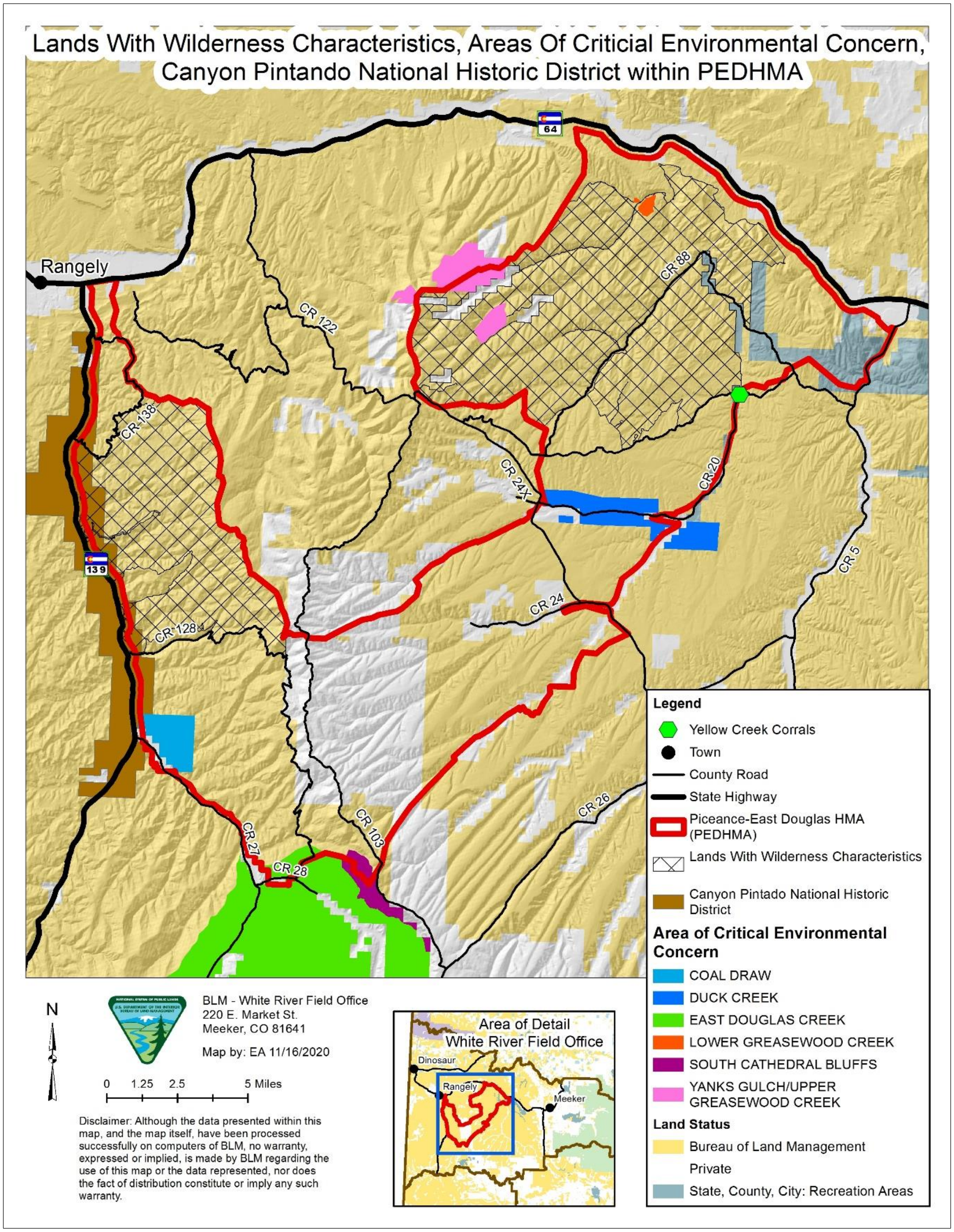


**Figure 2. Lands with Wilderness Characteristics, Areas of Critical Environmental Concern, and National Historic District within PEDHMA**



# APPENDIX B. REVIEW OF CURRENT SITUATION MEMO

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
White River Field Office
220 East Market Street, Meeker, Co. 81641
(970)878-3800

In Reply Refer To:
4720

October 19, 2020

**Memorandum**

**To:** Kent E. Walter, Field Manager, White River Field Office

**From:** Kyle Arnold, White River Field Office, Renewable Resources Staff Supervisor

**Subject:** Removal of Excess Wild Horses in the Piceance-East Douglas Herd Management Area

**Introduction**

Wild horse populations within the White River Field Office (WRFO) are above management objectives as identified in the Resource Management Plan (and amendments) for the Piceance-East Douglas Herd Management Area (PEDHMA). Populations have continued to increase to a level that has never been reached in the WRFO. As the population increases inside the PEDHMA the occurrences of excess wild horses temporarily or permanently relocating outside of the PEDHMA increases due to the animals attempts to find the forage, water, cover, and space that they seek to survive. The population increase within the PEDHMA can be described as covering the entire boundary of the PEDHMA and at this time does not represent a thriving natural ecological balance of wild horses with other resource values in the WRFO. Due to the high numbers of wild horses located both inside and outside of the PEDHMA (levels that have never been reached before) the WRFO has and will continue to receive requests to remove excess wild horses from private lands with the most recent from August 2019 through August 2020.

**Piceance-East Douglas Herd Management Area**

Through previous Land Use Plan decisions the WRFO chose to manage wild horses in the PEDHMA, which was designated in 1986 for the long-term management of wild horses, on the selected range from the Piceance Basin Herd Unit, and the portion of the Douglas Creek Herd Unit east of Douglas Creek. In 1997, through the Resource Management Plan (RMP) the PEDHMA was expanded adding approximately 28,830 acres known as the Greasewood Allotment. The current PEDHMA is comprised of approximately 158,310 acres of public; 5,330 acres of state; and 26,490 acres of private lands totaling approximately 190,130 acres. The present day PEDHMA contained the largest concentration of wild horses during the original census conducted in 1974, 141 of the 154 wild horses counted during this inventory were found within the current PEDHMA boundary. In the 1980 Management Framework Plan, the Appropriate Management Level (AML) was set at 95-140 wild horses and would be managed within the selected range. this was carried forward in the 1997 RMP. The AML was adjusted upward in 2002 to the

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current range of 135-235 wild horses.

## Rationale for a Gathering Excess Wild Horses

**Private Land Requests**

As noted above, the WRFO has and will continue to receive multiple requests from the private land owners both inside and outside of the PEDHMA to come gather excess wild horses due to the impacts associated with an overpopulation of wild horses described as: 1) consumption of meadows by wild horses results in not being able to utilize pasture because feed is removed; 2) fencing around the ranch does not keep the wild horses out; and 3) the wild horses are destroying water resources. Private land requests were one of the driving factors for the completion of the Tommys Draw fence in 2017 along with the Environmental Assessment to remove excess horses that had relocated outside of the PEDHMA.

The BLM's regulations at 43 CFR 4720.2-1 provide direction on removing excess wild horses when a request is received requesting removal of wild horses from private lands.

**Wild Horse Population Estimates**

In February 2016, the WRFO conducted a wild horse aerial inventory and that resulted in a count of 337 located within the PEDHMA. Since that inventory, the wild horse population has continued to increase at an approximate 20 percent recruitment rate that has been used for this region, bringing the current estimated PEDHMA population 838 wild horses after the 2020 foaling season. The Appropriate Management Level (AML) within the PEDHMA is 135-235 wild horses which results in a current estimated excess of between 603 to 703 wild horses just within the PEDHMA.

The WRFO has also identified excess wild horses that have relocated outside of the PEDHMA. Assuming a 20 percent recruitment rate each year since 2016, the estimated population of excess wild horses outside of the PEDHMA is at 438.

These current wild horse estimates within and outside the PEDHMA result in a total of 1,041 to 1,141 wild horses in excess within the WRFO.

## Recommendation to Management

The WRFO must begin development of a gather plan to remove excess wild horses from within the PEDHMA (see attached map). As you know, the WRFO has designated the PEDHMA for the long-term management of wild horses. BLM Manual 4720 defines excess animals "as those animals which must be removed from an area to preserve and maintain a thriving natural ecological balance (TNEB) and multiple-use relationship in that area. This definition includes wild horses or burros located outside the HMA in areas not designated for their long-term maintenance" (BLM Manual 4720.12). It is important that the WRFO immediately begin development of a gather/removal plan to address excess wild horses in accordance with 43 CFR 4720.2-1. NEPA is already in place to conduct wild horse gathers outside of the PEDHMA (doiblmcoN0520150023ea, doiblmcoN0520170056ea and doiblmcoN0520180071dna). Currently, staff is working on the NEPA document to remove excess wild horses located within the PEDHMA, it is on schedule to be completed this coming February 2021.

Staff recommendation is to remove excess wild horses impacting natural resources within the WRFO, within and outside of the PEDHMA. Wild horse population levels are resulting in overutilization of forage and water resources on public and private lands.

Attachment:
Map

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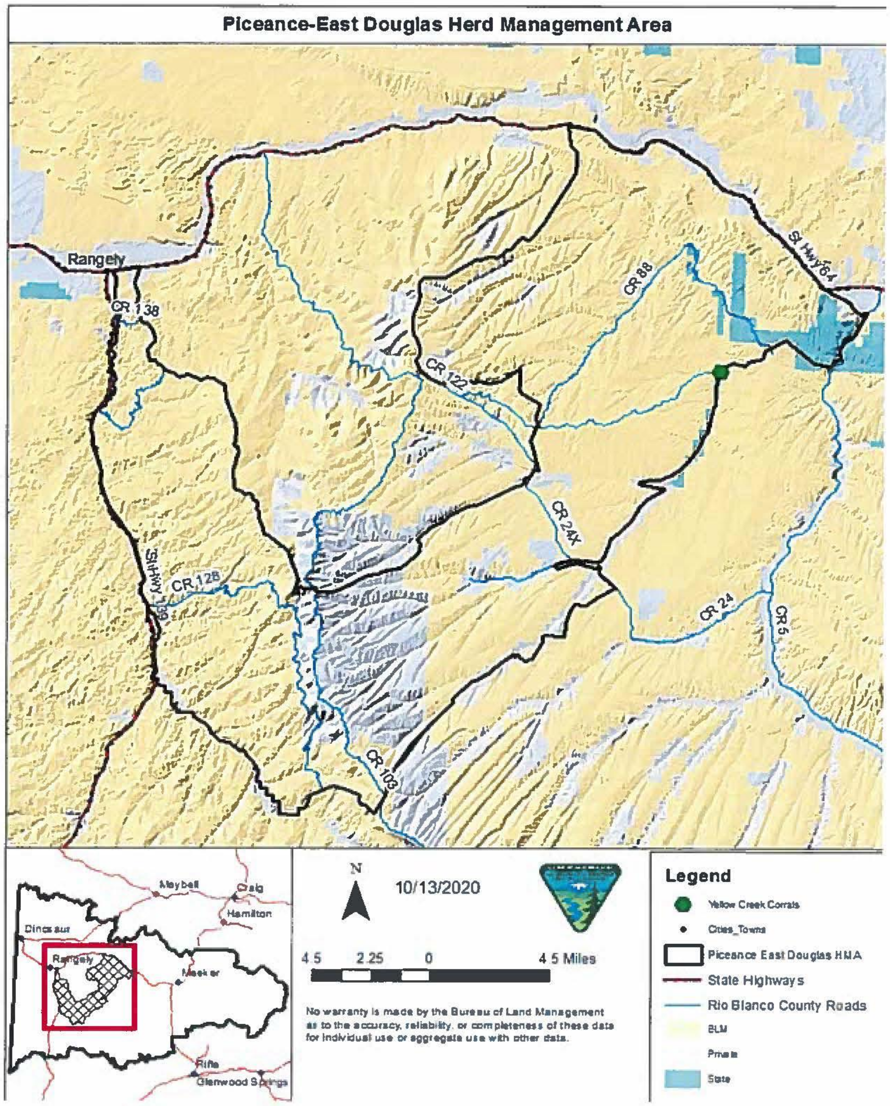


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# APPENDIX C. EXCESS DETERMINATION MEMO

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
White River Field Office
220 East Market Street
Meeker, CO 81641

In Reply Refer To: 4720
(CO-LLCON05000)

October 22, 2020

Memorandum

To: Catherine Cook, Acting Northwest District Manager

From: Kent E. Walter, Field Manager, White River Field Office

Subject: Removal of Excess Wild Horses from within the Piceance-East Douglas Herd Management Area

**Introduction**

Piceance-East Douglas Herd Management Area Wild Horse Population Estimates

In February 2016, the WRFO conducted a wild horse aerial inventory that resulted in a count of 337 wild horses located within the Piceance-East Douglas Herd Management Area (PEDHMA). Since that inventory, the wild horse population has continued to increase at an approximate 20 percent recruitment rate bringing the current estimated PEDHMA wild horse population to 838 wild horses by fall 2020. The Appropriate Management Level (AML) within the PEDHMA is 135-235 wild horses so at this time there is an estimated excess of between 603 to 703 wild horses just within the PEDHMA so currently at more than 3.5 times over the AML.

The WRFO has also identified excess wild horses that have relocated outside of the PEDHMA (in the North Piceance Herd Area, West Douglas Herd Area, and other areas beyond these boundaries). Continuing with a 20 percent recruitment rate each year since 2016 but less the gather operation of 2017 the current estimated population of excess wild horses outside of the PEDHMA is 438.

These excess wild horse estimates within and outside of the PEDHMA result in a current total of 1,041 to 1,141 inside the WRFO boundary. The current wild horse overpopulation levels are resulting in over utilization of the primary resources (forage and water) on public, state, and private lands within and outside the PEDHMA. As a result, this is negatively impacting our ability to persevere and maintain a thriving natural ecological balance (TNEB) and multiple-use relationship in that area.

**Recommendation to Management**

The WRFO has NEPA in place to conduct wild horses gathers outside of the PEDHMA (DOI-BLM-CO-N050-2015-0023-EA, DOI-BLM-CO-N050-2017-0056-EA, and DOI-BLM-CO-N050-

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2018-0071-DNA) but have lacked the approval to conducted such gather operations inside the PEDHMA.

The WRFO must begin development of a gather plan to remove excess wild horses from within the PEDHMA (see attached map). As you know, the PEDHMA was designated for the long-term management of wild horses. BLM Manual 4720 defines excess animals "… as those animals which must be removed from an area to preserve and maintain a thriving natural ecological balance (TNEB) and multiple-use relationship in that area. This definition includes wild horses and burros located outside of the HMA in areas not designated for their long-term maintenance." (BLM Manual 4720.12).

It is important that the WRFO immediately complete a 10-year gather and removal plan to address excess wild horses located within the PEDHMA in accordance with 43 CFR 4720.2-1. Currently, staff is working on that NEPA document to gather and remove excess wild horses and propose the initial and future use of fertility control treatments from within the PEDHMA.

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# APPENDIX D. ANIMAL WELFARE STANDARDS

The following is Attachment 1 from BLM Permanent Instruction Memorandum (PIM) 2021-002. Standards for transportation, off-range corral facilities, and adoption events are not shown here, but are available via https://www.blm.gov/policy/pim-2021-002

## ATTACHMENT 1: COMPREHENSIVE ANIMAL WELFARE PROGRAM FOR WILD HORSE AND BURRO GATHERS

## STANDARDS

Developed by

The Bureau of Land Management
Wild Horse and Burro Program

in collaboration with

Carolyn L. Stull, PhD
Kathryn E. Holcomb, PhD
University of California, Davis
School of Veterinary Medicine

June 30, 2015

## WELFARE ASSESSMENT STANDARDS for GATHERS

## CONTENTS

## STANDARDS

**Standard Definitions**

**Major Standard:** Impacts the health or welfare of WH&Bs. Relates to an alterable equipment or facility standard or procedure. Appropriate wording is "must," "unacceptable," "prohibited."

**Minor Standard:** unlikely to affect WH&Bs health or welfare or involves an uncontrollable situation. Appropriate wording is "should."

**Lead COR** = Lead Contracting Officer's Representative
**COR** = Contracting Officer's Representative
**PI** = Project Inspector
**WH&Bs** = Wild horses and burros

## I. FACILITY DESIGN

### A. Trap Site and Temporary Holding Facility

1. The trap site and temporary holding facility must be constructed of stout materials and must be maintained in proper working condition, including gates that swing freely and latch or tie easily. (**major**)
2. The trap site should be moved close to WH&B locations whenever possible to minimize the distance the animals need to travel.(minor)
3. If jute is hung on the fence posts of an existing wire fence in the trap wing, the wire should be either be rolled up or let down for the entire length of the jute in such a way that minimizes the possibility of entanglement by WH&Bs unless otherwise approved by the Lead COR/COR/PI. (minor)
4. Fence panels in pens and alleys must be not less than 6 feet high for horses, 5 feet high for burros, and the bottom rail must not be more than 12 inches from ground level. (**major**)

5. The temporary holding facility must have a sufficient number of pens available to sort WH&Bs according to gender, age, number, temperament, or physical condition. (**major**)
   a. All pens must be assembled with capability for expansion. (**major**)
   b. Alternate pens must be made available for the following: (**major**)
      1) WH&Bs that are weak or debilitated
      2) Mares/jennies with dependent foals
   c. WH&Bs in pens at the temporary holding facility should be maintained at a proper stocking density such that when at rest all WH&Bs occupy no more than half the pen area. (minor)
6. An appropriate chute designed for restraining WH&Bs must be available for necessary procedures at the temporary holding facility. This does not apply to bait trapping operations unless directed by the Lead COR/COR/PI. (**major**)
7. 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. (**major**)
8. Padding must be installed on the overhead bars of all gates and chutes used in single file alleys. (**major**)
9. Hinged, self-latching gates must be used in all pens and alleys except for entry gates into the trap, which may be secured with tie ropes. (**major**)
10. Finger gates (one-way funnel gates) used in bait trapping must be constructed of materials approved by the Lead COR/COR/PI. Finger gates must not be constructed of materials that have sharp ends that may cause injuries to WH&Bs, such as "T" posts, sharpened willows, etc. (**major**)
11. Water must be provided at a minimum rate of ten gallons per 1000 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). Water must be refilled at least every morning and evening. (**major**)
12. The design of pens at the trap site and temporary holding facility should be constructed with rounded corners. (minor)

13. All gates and panels in the animal holding and handling pens and alleys of the trap site must be covered with materials such as plywood, snow fence, tarps, burlap, etc. approximately 48" in height to provide a visual barrier for the animals. All materials must be secured in place.(**major**)

    These guidelines apply:

    a. For exterior fences, material covering panels and gates must extend from the top of the panel or gate toward the ground.(**major** )
    b. For alleys and small internal handling pens, material covering panels and gates should extend from no more than 12 inches below the top of the panel or gate toward the ground to facilitate visibility of animals and the use of flags and paddles during sorting. (minor)
    c. The initial capture pen may be left uncovered as necessary to encourage animals to enter the first pen of the trap. (minor)
14. Non-essential personnel and equipment must be located to minimize disturbance of WH&Bs. (**major**)
15. Trash, debris, and reflective or noisy objects should be eliminated from the trap site and temporary holding facility. (minor)

**B. Loading and Unloading Areas**

1. Facilities in areas for loading and unloading WH&Bs at the trap site or temporary holding facility must be maintained in a safe and proper working condition, including gates that swing freely and latch or tie easily. (**major**)
2. The side panels of the loading chute must be a minimum of 6 feet high and fully covered with materials such as plywood or metal without holes that may cause injury. (**major**)
3. There must be no holes, gaps or openings, protruding surfaces, or sharp edges present in fence panels or other structures that may cause escape or possible injury. (**major**)
4. All gates and doors must open and close easily and latch securely. (**major**)

5. Loading and unloading ramps must have a non-slip surface and be maintained in a safe and proper working condition to prevent slips and falls. Examples of non-slip flooring would include, but not be limited to, rubber mats, sand, shavings, and steel reinforcement rods built into ramp. There must be no holes in the flooring or items that can cause an animal to trip. (**major**)
6. Trailers must be properly aligned with loading and unloading chutes and panels such that no gaps exist between the chute/panel and floor or sides of the trailer creating a situation where a WH&B could injure itself. (**major**)
7. Stock trailers should 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. (minor)

## II. CAPTURE TECHNIQUE

### A. Capture Techniques

1. WH&Bs gathered on a routine basis for removal or return to range must be captured by the following approved procedures under direction of the Lead COR/COR/PI. (**major**)
   a. Helicopter
   b. Bait trapping
2. WH&Bs must not be captured by snares or net gunning. (**major**)
3. Chemical immobilization must only be used for capture under exceptional circumstances and under the direct supervision of an on-site veterinarian experienced with the technique. (**major**)

### B. Helicopter Drive Trapping

1. The helicopter must be operated using pressure and release methods to herd the animals in a desired direction and should not repeatedly evoke erratic behavior in the WH&Bs causing injury or exhaustion. Animals must not be pursued to a point of exhaustion; the on-site veterinarian must examine WH&Bs for signs of exhaustion. (**major**)

2. The rate of movement and distance the animals travel must not exceed limitations set by the Lead COR/COR/PI who will consider terrain, physical barriers, access limitations, weather, condition of the animals, urgency of the operation (animals facing drought, starvation, fire, etc.) and other factors. (**major**)
   a. WH&Bs that are weak or debilitated must be identified by BLM staff or the contractors. Appropriate gather and handling methods should be used according to the direction of the Lead COR/COR/PI. (**major**)
   b. The appropriate herding distance and rate of movement must be determined on a case-by-case basis considering the weakest or smallest animal in the group (e.g., foals, pregnant mares, or horses that are weakened by body condition, age, or poor health) and the range and environmental conditions present. (**major**)
   c. Rate of movement and distance travelled must not result in exhaustion at the trap site, with the exception of animals requiring capture that have an existing severely compromised condition prior to gather. Where compromised animals cannot be left on the range or where doing so would only serve to prolong their suffering, euthanasia will be performed in accordance with BLM policy. (**major**)
3. WH&Bs must not be pursued repeatedly by the helicopter such that the rate of movement and distance travelled exceeds the limitation set by the Lead COR/COR/PI. Abandoning the pursuit or alternative capture methods may be considered by the Lead COR/COR/PI in these cases. (**major**)
4. When WH&Bs are herded through a fence line en route to the trap, the Lead COR/COR/PI must be notified by the contractor. The Lead COR/COR/PI must determine the appropriate width of the opening that the fence is let down to allow for safe passage through the opening. The Lead COR/COR/PI must decide if existing fence lines require marking to increase visibility to WH&Bs. (**major**)
5. The helicopter must not come into physical contact with any WH&B. The physical contact of any WH&B by helicopter must be documented by Lead COR/COR/PI along with the circumstances. (**major**)
6. WH&Bs may escape or evade the gather site while being moved by the helicopter. If there are mare/dependent foal pairs in a group being brought to a trap and half of an identified pair is thought to have evaded capture, multiple attempts by helicopter may

be used to bring the missing half of the pair to the trap or to facilitate capture by roping. In these instances, animal condition and fatigue must be evaluated by the Lead COR/COR/PI or on-site veterinarian on a case-by-case basis to determine the number of attempts that can be made to capture an animal.(**major**)

7. Horse captures must not be conducted when ambient temperature at the trap site is below 10ºF or above 95ºF without approval of the Lead COR/COR/PI. Burro captures must not be conducted when ambient temperature is below 10ºF or above 100ºF without approval of the Lead COR/COR/PI. The Lead COR/COR/PI will not approve captures when the ambient temperature exceeds 105 ºF. (**major**)

**C. Roping**

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

8. Halters and ropes tied to a WH&B may be used to roll, turn, position or load a recumbent animal, but a WH&B must not be dragged across the ground by a halter or rope attached to its body while in a recumbent position. (**major**)
9. Animals captured by roping must be evaluated by the on-site/on-call veterinarian within four hours after capture, marked for identification at the trap site, and be re-evaluated periodically as deemed necessary by the on-site/on-call veterinarian. (**major**)

### D. Bait Trapping

1. WH&Bs may be lured into a temporary trap using bait (feed, mineral supplement, water) or sexual attractants (mares/jennies in heat) with the following requirements:
   a. The period of time water sources other than in the trap site are inaccessible must not adversely affect the wellbeing of WH&Bs, wildlife or livestock, as determined by the Lead COR/COR/PI. (**major**)
   b. Unattended traps must not be left unobserved for more than 12 hours. (**major**)
   c. Mares/jennies and their dependent foals must not be separated unless for safe transport. (**major**)
   d. WH&Bs held for more than 12 hours must be provided with accessible clean water at a minimum rate of ten gallons per 1000 pound animal per day, adjusted accordingly for larger or smaller horses, burros and foals and environmental conditions. (**major**)
   e. WH&Bs held for more than 12 hours must be provided good quality hay at a minimum rate of 20 pounds per 1000 pound adult animal per day, adjusted accordingly for larger or smaller horses, burros and foals. (**major**)
      1) Hay must not contain poisonous weeds, debris, or toxic substances. (**major**)
      2) Hay placement must allow all WH&Bs to eat simultaneously. (**major**)

## III. WILD HORSE AND BURRO CARE

### A. Veterinarian

1. On-site veterinary support must be provided for all helicopter gathers and on-site or on-call support must be provided for bait trapping. (**major**)

2. Veterinary support must be under the direction of the Lead COR/COR/PI. The on-site/on-call veterinarian will provide consultation on matters related to WH&B health, handling, welfare, and euthanasia at the request of the Lead COR/COR/PI. All decisions regarding medical treatment or euthanasia will be made by the on-site Lead COR/COR/PI. (**major**)

**B. Care**

1. 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 with water available at all times other than when animals are being sorted or worked. (**major)**
   b. Water must be provided at a minimum rate of ten gallons per 1000 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). . (**major**)
   c. Good quality hay must be fed at a minimum rate of 20 pounds per 1000 pound adult animal per day, adjusted accordingly for larger or smaller horses, burros and foals. (**major**)
      i. Hay must not contain poisonous weeds or toxic substances. (**majo**r)
      ii. Hay placement must allow all WH&Bs to eat simultaneously. (**major**)
   d. When water or feed deprivation conditions exist on the range prior to the gather, the Lead COR/COR/PI should adjust the watering and feeding arrangements in consultation with the onsite veterinarian as necessary to provide for the needs of the animals. (minor)
2. Dust abatement
   a. Dust abatement by spraying the ground with water must be employed when necessary at the trap site and temporary holding facility. (**major**)

3. Trap Site
    a. Dependent foals or weak/debilitated animals 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 Lead COR/COR/PI authorizes a longer time or a decision is made to wean the foals. (**major**)
4. Temporary Holding Facility
    a. All WH&Bs in confinement must be observed at least once daily to identify sick or injured WH&Bs and ensure adequate food and water. (**major**)
    b. Foals must be reunited with their mares/jennies at the temporary holding facility within four hours of capture unless the Lead COR/COR/PI authorizes a longer time or foals are old enough to be weaned during the gather. (**major**)
    c. Non-ambulatory WH&Bs must be located in a pen separate from the general population and must be examined by the BLM horse specialist and/or on-call or on-site veterinarian as soon as possible, no more than four hours after recumbency is observed. Unless otherwise directed by a veterinarian, hay and water must be accessible to an animal within six hours after recumbency.(**major**)
    d. Alternate pens must be made available for the following: (**major**)
        1) WH&Bs that are weak or debilitated
        2) Mares/jennies with dependent foals
    e. Aggressive WH&Bs causing serious injury to other animals should be identified and relocated into alternate pens when possible. (minor)
    f. WH&Bs in pens at the temporary holding facility should be maintained at a proper stocking density such that when at rest all WH&Bs occupy no more than half the pen area. (minor)

## C. Biosecurity

1. Health records for all saddle and pilot horses used on WH&B gathers must be provided to the Lead COR/COR/PI prior to joining a gather, including: (**major**)
   a. Certificate of Veterinary Inspection (Health Certificate, within 30 days).
   b. Proof of:
      1) A negative test for equine infectious anemia (Coggins or EIA ELISA test) within 12 months.
      2) Vaccination for tetanus, eastern and western equine encephalomyelitis, West Nile virus, equine herpes virus, influenza, *Streptococcus equi*, and rabies within 12 months.
2. Saddle horses, pilot horses and mares used for bait trapping lures must not be removed from the gather operation (such as for an equestrian event) and allowed to return unless they have been observed to be free from signs of infectious disease for a period of at least three weeks and a new Certificate of Veterinary Examination is obtained after three weeks and prior to returning to the gather. (**major**)
3. WH&Bs, saddle horses, and pilot horses showing signs of infectious disease must be examined by the on-site/on-call veterinarian. (**major**)
   a. Any saddle or pilot horses showing signs of infectious disease (fever, nasal discharge, or illness) must be removed from service and isolated from other animals on the gather until such time as the horse is free from signs of infectious disease and approved by the on-site/on-call veterinarian to return to the gather. (**major**)
   b. Groups of WH&Bs showing signs of infectious disease should not be mixed with groups of healthy WH&Bs at the temporary holding facility, or during transport. (minor)
4. Horses not involved with gather operations should remain at least 300 yards from WH&Bs, saddle horses, and pilot horses being actively used on a gather. (minor)

## IV. HANDLING

### A. Willful Acts of Abuse

1. Hitting, kicking, striking, or beating any WH&B in an abusive manner is prohibited. (**major**)
2. Dragging a recumbent WH&B without a sled, slide board or slip sheet is prohibited. 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 II. C. 8. (**major**)
3. There should be no deliberate driving of WH&Bs into other animals, closed gates, panels, or other equipment. (minor)
4. There should be no deliberate slamming of gates and doors on WH&Bs. (minor)
5. There should be no excessive noise (e.g., constant yelling) or sudden activity causing WH&Bs to become unnecessarily flighty, disturbed or agitated. (minor)

### B. General Handling

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

### C. Handling Aids

1. Handling aids such as flags and shaker paddles must be the primary tools for driving and moving WH&Bs during handling and transport procedures. Contact of the flag or paddle end of primary handling aids 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. (**major**)

2. Electric prods must not be used routinely as a driving aid or handling tool. Electric prods may be used in limited circumstances only if the following guidelines are followed:
   a. Electric prods must only be a commercially available make and model that uses DC battery power and batteries should be fully charged at all times. (**major**)
   b. The electric prod device must never be disguised or concealed. (**major**)
   c. Electric prods must only be used after three attempts using other handling aids (flag, shaker paddle, voice or body position) have been tried unsuccessfully to move the WH&Bs. (**major**)
   d. Electric prods must only be picked up when intended to deliver a stimulus; these devices must not be constantly carried by the handlers. (**major**)
   e. Space in front of an animal must be available to move the WH&B forward prior to application of the electric prod. (**major**)
   f. Electric prods must never be applied to the face, genitals, anus, or underside of the tail of a WH&B. (**major**)
   g. Electric prods must not be applied to any one WH&B more than three times during a procedure (e.g., sorting, loading) except in extreme cases with approval of the Lead COR/COR/PI. Each exception must be approved at the time by the Lead COR/COR/PI. (**major**)
   h. Any electric prod use that may be necessary must be documented daily by the Lead COR/COR/PI including time of day, circumstances, handler, location (trap site or temporary holding facility), and any injuries (to WH&B or human). (**major**)

## V. 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 Lead COR/CO/PI approves the use of supplemental light. (**major**)

2. WH&Bs identified for removal should be shipped from the temporary holding facility to a BLM facility within 48 hours. (minor)
   a. Shipping delays for animals that are being held for release to range or potential on-site adoption must be approved by the Lead COR/COR/PI. (**major**)
3. Shipping should occur in the following order of priority; 1) debilitated animals, 2) pairs, 3) weanlings, 4) dry mares and 5) studs. (minor)
4. Planned
5. transport time to the BLM preparation facility from the trap site or temporary holding facility must not exceed 10 hours. (**major**)
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. (minor)

**B. Vehicles**

1. Straight-deck trailers and stock trailers must be used for transporting WH&Bs. (**major**)
   a. Two-tiered or double deck trailers are prohibited. (**major**)
   b. Transport vehicles for WH&Bs must have a covered roof or overhead bars containing them such that WH&Bs cannot escape. (**major**)
2. WH&Bs must have adequate headroom during loading and unloading and must be able to maintain a normal posture with all four feet on the floor during transport without contacting the roof or overhead bars. (**major**)
3. The width and height of all gates and doors must allow WH&Bs to move through freely. (**major**)
4. All gates and doors must open and close easily and be able to be secured in a closed position. (**major**)
5. The rear door(s) of the trailers must be capable of opening the full width of the trailer. (**major**)
6. Loading and unloading ramps must have a non-slip surface and be maintained in proper working condition to prevent slips and falls. (**major**)

7. Transport vehicles more than 18 feet and less than 40 feet in length must have a minimum of one partition gate providing two compartments; transport vehicles 40 feet or longer must have at least two partition gates to provide a minimum of three compartments. (**major**)
8. All partitions and panels inside of trailers must be free of sharp edges or holes that could cause injury to WH&Bs. (**major**)
9. The inner lining of all trailers must be strong enough to withstand failure by kicking that would lead to injuries. (**major**)
10. Partition gates in transport vehicles should be used to distribute the load into compartments during travel. (minor)
11. Surfaces and floors of trailers must be cleaned of dirt, manure and other organic matter prior to the beginning of a gather. (**major**)

**C. Care of WH&Bs during Transport Procedures**

1. WH&Bs that are loaded and transported from the temporary holding facility to the BLM preparation facility must be fit to endure travel. (**major**)
    a. WH&Bs that are non-ambulatory, blind in both eyes, or severely injured must not be loaded and shipped unless it is to receive immediate veterinary care or euthanasia. (**major**)
    b. WH&Bs that are weak or debilitated must not be transported without approval of the Lead COR/COR/PI in consultation with the on-site veterinarian. Appropriate actions for their care during transport must be taken according to direction of the Lead COR/COR/PI. (**major**)
2. WH&Bs should be sorted prior to transport to ensure compatibility and minimize aggressive behavior that may cause injury. (minor)
3. Trailers must be loaded using the minimum space allowance in all compartments as follows: (**major**)
    a. 12 square feet per adult horse.
    b. 6.0 square feet per dependent horse foal.
    c. 8.0 square feet per adult burro.
    d. 4.0 square feet per dependent burro foal.

4. The Lead COR/COR/PI in consultation with the receiving Facility Manager must document any WH&B that is recumbent or dead upon arrival at the destination. (**major**)
   a. Non-ambulatory or recumbent WH&Bs must be evaluated on the trailer and either euthanized or removed from the trailers using a sled, slide board or slip sheet. (**major**)
5. Saddle horses must not be transported in the same compartment with WH&Bs. (**major**)

## VI. EUTHANASIA OR DEATH

### A. 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. (**major**)
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. (**major**)
3. The decision to euthanize and method of euthanasia must be directed by the Authorized Officer or their Authorized Representative(s) that include but are not limited to the Lead COR/COR/PI who must be on site and may consult with the on-site/on-call veterinarian. (**major**)
4. Photos needed to document an animal's condition should be taken prior to the animal being euthanized. No photos of animals that have been euthanized should be taken. An exception is when a veterinarian or the Lead COR/COR/PI may want to document certain findings discovered during a postmortem examination or necropsy. (minor)
5. Any WH&B that dies or is euthanized must be documented by the Lead COR/COR/PI including time of day, circumstances, euthanasia method, location, a

description of the age, gender, and color of the animal and the reason the animal was euthanized. (**major**)

6. The on-site/on-call veterinarian should review the history and conduct a postmortem physical examination of any WH&B that dies or is euthanized during the gather operation. A necropsy should be performed whenever feasible if the cause of death is unknown. (minor)

**B. Carcass Disposal**

1. The Lead COR/COR/PI must ensure that appropriate equipment is available for the timely disposal of carcasses when necessary on the range, at the trap site, and temporary holding facility. (**major**)
2. Disposal of carcasses must be in accordance with state and local laws. (**major**)
3. WH&Bs euthanized with a barbiturate euthanasia agent must be buried or otherwise disposed of properly. (**major**)
4. 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. (minor)

## CAWP

## REQUIRED DOCUMENTATION AND RESPONSIBILITIES OF LEAD COR/COR/PI

### Required Documentation

| Section | Documentation |
|---|---|
| II.B.5 | Helicopter contact with any WH&B. |
| II.C.2 | Roping of any WH&B. |
| III.B.3.a and III.B.4.b | Reason for allowing longer than four hours to reunite foals with mares/jennies. Does not apply if foals are being weaned. |
| III.C.1 | Health status of all saddle and pilot horses. |
| IV.C.2.h | All uses of electric prod. |
| V.C.4 | Any WH&B that is recumbent or dead upon arrival at destination following transport. |
| VI.A.5 | Any WH&B that dies or is euthanized during gather operation. |

**Responsibilities**

| Section | Responsibility |
|---|---|
| I.A.10 | Approve materials used in construction of finger gates in bait trapping |
| II.A.1 | Direct gather procedures using approved gather technique. |
| II.B. 2 | Determine rate of movement and distance limitations for WH&B helicopter gather. |
| II.B.2.a | Direct appropriate gather/handling methods for weak or debilitated WH&B. |
| II.B.3 | Determine whether to abandon pursuit or use other capture method in order to avoid repeated pursuit of WH&B. |
| II.B.4 | Determine width and need for visibility marking when using opening in fence en route to trap. |
| II.B.6 | Determine number of attempts that can be made to capture the missing half of a mare/foal pair that has become separated. |
| II.B.7 | Determine whether to proceed with gather when ambient temperature is outside the range of 10°F to 95°F for horses or 10°F to 100°F for burros. |
| II.C.1 | Approve roping of any WH&B. |
| II.D.1.a | Determine period of time that water outside a bait trap is inaccessible such that wellbeing of WH&Bs, wildlife, or livestock is not adversely affected. |
| III.A.2 | Direct and consult with on-site/on-call veterinarian on any matters related to WH&B health, handling, welfare and euthanasia. |

| | |
|---|---|
| III.B.1.e | Adjust feed/water as necessary, in consultation with onsite/on call veterinarian, to provide for needs of animals when water or feed deprivation conditions exist on range. |
| III.B.4.c | Determine provision of water and hay to non-ambulatory animals. |
| IV.C.2.g | Approve use of electric prod more than three times, for exceptional cases only. |
| V.A.1 | Approve sorting, loading, or unloading at night with use of supplemental light. |
| V.A.2.a | Approve shipping delays of greater than 48 hours from temporary holding facility to BLM facility. |
| V.C.1.b | Approve of transport and care during transport for weak or debilitated WH&B. |
| VI.A.3 | Direct decision regarding euthanasia and method of euthanasia for any WH&B; may consult with on-site/on-call veterinarian. |
| VI.B.1 | Ensure that appropriate equipment is available for carcass disposal. |

# APPENDIX E. ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

The following alternatives were considered but dismissed from detailed analysis for the reasons described below.

## E.1. Alternative Gather Methods

***Bait Trap Only***

The BLM considered the use of bait-trapping as the primary gathering method. The use of bait-trapping, though effective in specific areas and circumstances, would be time-consuming and not cost-effective, considering the historical difficulties of gathering excess wild horses within the Piceance-East Douglas Herd Management Area (PEDHMA). Bait-trapping would also be impractical as the primary gather method for the PEDHMA due to the number of excess wild horses that need to be gathered and removed. However, bait-trapping could be used to help achieve Appropriate Management Level (AML) if gather efficiencies are too low using a helicopter or if a helicopter gather cannot be scheduled. This alternative was dismissed from detailed analysis as the primary gather method for the following reasons: 1) the project area is too large to effectively use this gather method; 2) road access for vehicles not associated with the gather to potential trapping locations is difficult to restrict and reduces gather efficiency; 3) road access necessary to get equipment in/out as well as safely transport gathered wild horses is limited; the amount of time required to come close to management objectives, and 4) the presence of scattered water resources on state, private and public lands inside the PEDHMA (some with no access) would make it almost impossible to restrict wild horse access to the extent necessary to gather and remove the excess animals if using bait-trapping achieve management goals.

***Use of Alternative Capture Techniques***

In other field offices, the public has suggested using capture methods (other than helicopters or bait-trapping) to gather excess wild horses. As no specific alternative methods were suggested, the BLM identified chemical immobilization, net-gunning, and wrangler/horseback drive trapping as potential methods for gathering wild horses. Net-gunning techniques normally used to capture big game also rely on helicopters. Chemical immobilization is a very specialized technique and strictly regulated. Currently the BLM does not have sufficient expertise to implement either of these methods and they would be impractical to use given the size of the PEDHMA, access limitations, number to be removed and approachability of the wild horses.

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

## E.2. Alternative Fertility Control Options

***Exclusively Using Field Darting to Deliver Fertility Treatments to Reduce Total Population Over Time***

The BLM considered administering PZP or Gonacon in the one-year dose inoculations by field darting the mares. These methods are currently approved for use and is being used by BLM in other HMAs. This alternative (darting fertility control only, no removals) was dismissed from detailed analysis because the reduction in population growth is not sufficient to reduce overutilization of rangeland resources by wild horses (or overall herd size) and thus would not meet the purpose and need of the action. For these reasons, this alternative was determined to not be an effective or feasible method for managing wild horse populations and reducing rangeland impacts from over population in a timely manner within the PEDHMA.

***Using Bait Trapping to Deliver Fertility Treatments to Reduce Total Population Over Time***

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

***Use of Fertility Control Treatments Only to Reduce Total Population Over Time***

This alternative would involve leaving the current wild horse population above AML and only using fertility control treatments to reduce wild horse population growth rates slowly over time (i.e., use fertility control to reduce population growth and wait for natural mortality to reduce the existing herd size) . However, in order to bring the wild horse population to within AML in a reasonable timeframe (i.e., less than 10 years) it is necessary to conduct periodic gather and removal operations (even with effective use of fertility control). Additionally, only using fertility control to reduce population size over time would not meet the purpose and need for this analysis, which includes managing the population within AML to prevent undue degradation of public lands and to restore a thriving natural ecological balance. Due to these factors, this alternative was not carried forward for detailed analysis.

***Gather and Release All (including Excess) Wild Horses Every Two Years and Apply PZP-22 Vaccine Pellets or Other Contraceptive Vaccine to Wild Horses For Release***

Another alternative to gather a substantial portion of the existing population (90 percent) and implement fertility control treatment only, without removal of excess wild horses using a two-year gather/treatment interval over a 10-year period, based on a previously-supposed effectiveness of PZP-22 pellet vaccine or similar (e.g., GonaCon). The wild horse population would continue to have an average population growth rate of 2.3 to 13.7 percent, thus adding to the current wild horse overpopulation, albeit at a slower rate of growth than the No Action Alternative. The WinEquus modeling showed that implementing this kind of strategy would not meet the needs of wild horse management in the PEDHMA. This alternative would not decrease the existing overpopulation of wild horses, resource concerns and rangeland deterioration would continue, and implementation would result in substantially increased gather and fertility control costs relative to the alternatives that remove excess wild horses to achieve the herd size range prescribed by AML. In addition to not achieving AML, the time needed to complete a gather would also increase over time, because the more frequently an area is gathered, and the greater the herd size, the gathering of wild horses becomes increasingly more difficult. Wild horses learn to evade the helicopter by taking cover in densely treed areas and access other areas generally in accessible (e.g., canyons). Wild horses tend to move out of an area when they hear a helicopter thereby further reducing the overall gather efficiency. Frequent gathers would increase the number of times wild horses would experience stress as individuals and the entire band/herd. It would become increasingly more difficult over time to repeat gather operations every two years to successfully treat a large portion of the population. For these reasons, this alternative was dropped from detailed study.

## E.3. Alternatives Related to Population Size or Structure

***Provide Supplemental Feed and Water***

To accommodate higher populations of wild horses it has been suggested during public questions and comments that the BLM provide supplemental feed (hay) and/or haul water other than during a short-term emergency. Such an approach would not meet the definition of minimum feasible management and is inconsistent with current law, regulation, and policy (refer to 43 CFR 4710.4).

***Return a Portion of the Population as a Non-Breeding Population***

This alternative would involve capturing, permanently sterilizing, and returning a portion of the population as a non-breeding population after the population is brought to the low end of AML. Those methods may be suitable for use in some HMAs. Unless there is a large fraction of the herd sterilized, most wild horse herds with a sterile component could still be self-sustaining. However, this alternative was not brought forward for detailed analysis because there has been a good record of success in BLM Colorado wild horse herds using temporary fertility control methods. BLM recognizes that some mares treated with temporary fertility control methods (vaccines and / or IUDs) may possibly die from age or other on-range circumstances after treatment, before becoming pregnant again. Nonetheless, mares treated repeatedly with temporary fertility control measures are not usually considered to constitute a non-breeding population.

***Utilize Only Sex Ratio Adjustment to Reduce Population Recruitment***

This alternative would involve gathering and releasing all wild horses back into the PEDHMA under a 60% male to 40% female sex ratio adjustment where more males than females would existing in order to bring the current estimated 20% recruitment rate down in order to curb gather operation occurrences. This alternative would be labor intensive could never, of itself, lead to the kind of reduced recruitment rates needed to reduce herd size. For those reasons, this alternative did not receive further consideration.

***Gather to the AML Upper Limit***

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

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

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

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

#### ***Adjust the Appropriate Management Level***

The Appropriate Management Level (AML) in the PEDHMA was established as a population range of 135-235 wild horses in the 2002 Piceance-East Douglas Wild Horse Herd Management Area EA (WR-02-049) following an in-depth analysis of habitat suitability, resource monitoring and population inventory data. The AML upper limit is the maximum number which can graze based on detailed analysis of the available water, forage, and other multiple uses. A Herd Management Area Plan (HMAP) established site-specific management and monitoring objectives for the herd and its habitat in 1981. The WRFO Wild Horse Program Analysis updated that plan and Operational Plan dated July 27, 1999. The 2011 EA (DOI-BLM-CO-110-0058-EA) also reviewed the current AML and found the 135-235 range appropriate for continued management of wild horses within the PEDHMA.

The AML for the PEDHMA has been thoroughly reviewed in previous analysis and for these reasons further evaluation of the AML did not receive further consideration in this document.

#### ***Wild Horse Numbers Controlled by Natural Means***

This alternative was eliminated from further consideration because it is contrary to the Wild and Free-Roaming Horse and Burro Act of 1971 (WFRHBA) that requires the BLM to prevent the range from deterioration associated with an overpopulation of wild horses. The alternative of using natural controls to achieve a desirable AML has not been shown to be feasible in the past (NAS 2013). Wild horses in the PEDHMA are not substantially regulated by predators (which includes mountain lions and bears). Also, predator numbers are regulated by Colorado Parks and Wildlife and not the BLM. In addition, wild horses are a long-lived species with documented foal survival rates regularly exceeding 90 percent and they are not a 'self-regulating' species. This alternative would result in a steady increase in numbers which would continually exceed the carrying capacity of the range until severe and unusual conditions that occur periodically -- such as blizzards or extreme drought -- cause catastrophic mortality of wild horses.

## E.4. Alternatives Inconsistent with Existing Land Use Plan Allocations

#### ***Return the PEDHMA To Herd Area Status with Zero AML***

Another alternative which has been suggested is to return the PEDHMA to Herd Area status and establish the AML as "0" animals due to resource concerns such as lack of forage, lack of water, and conflicts with other resources. The PEDHMA is expected to provide the necessary forage, water resources, cover and space to support a wild horse population of 135-235 animals.

Additionally, this alternative would not be in conformance with existing land use plan decisions in the 1997 RMP because it is identified as an HMA rather than an HA.

***Manage the Entire Population as a Non-Breeding Population***
A management alternative which has been suggested is to manage the PEDHMA in its entirety as a non-breeding population of wild horses (e.g. entire herd of geldings). This alternative is not in conformance with the direction in the 1997 RMP, as amended to manage wild horses in the PEDHMA "to provide a healthy, viable breeding population with a diverse age structure" (page 2-26).

***Remove Livestock within the PEDHMA***
This alternative would involve no removal of wild horses and instead address the wild horse numbers and associated consumption of forage, through the removal of livestock within the PEDHMA. This alternative was not brought forward for detailed analysis because it is not in conformance with the 1997 RMP which allows for livestock grazing within the PEDHMA; the elimination of livestock grazing in an area would require an amendment to the RMP.

In previously analyzed the DOI-BLM-CO-110-2011-0058-EA, the BLM considered incrementally reducing forage allocated to livestock in the PEDHMA as wild horse populations continued to increase without intervention from a gather (Alternative C). In section 4.6.4 of the 2011 EA, the analysis demonstrated that the unchecked population growth of wild horses would within a few years eliminate forage allocations for livestock. Effectively eliminating forage allocations through an implementation decision (i.e., grazing permit) would be essentially similar to a decision to remove livestock from the PEDHMA, which, as described above, is inconsistent with the 1997 RMP.

# APPENDIX F. POPULATION MODEL

## F.1. Population Model Overview

Population modeling is a tool designed to help BLM evaluate various management alternatives and possible outcomes for management of wild horses. The population model is not applicable for burros.

The WinEquus program, developed by Dr. Steven Jenkins at the University of Nevada at Reno was designed to assist wild horse and burro specialists in evaluating various management alternatives that could be considered for a particular area.

The model uses data on average survival probabilities and foaling rates of horses to simulate population growth for up to 20 years. The model accounts for year-to-year variation in these demographic parameters by using a randomization process to select survival probabilities and foaling rates for each age class from a distribution of values based on these averages. This aspect of population dynamics is called environmental stochasticity and reflects the fact that future environmental conditions that may affect horse populations cannot be known in advance. Therefore, each trial within the model will give a different pattern of population growth. Some trials may include mostly “good years”, when the population grows rapidly; other trials may include a series of several “bad” years in succession. The stochastic approach to population modeling uses repeated trials to project a range of possible population trajectories over a period of years, which is more realistic than predicting a single specific trajectory.

The model can incorporate selective removal and fertility control treatment as management strategies. A simulation may include no management, selective removal, fertility control treatment, or both removal and fertility control treatment. BLM can specify many different options for these management strategies such as the schedule of gathers for removal or fertility control treatment, the threshold population size which triggers a gather, the target population size following a removal, the ages and sexes of horses to be removed, and the effectiveness of fertility control treatment.

Modeling was completed for the Piceance-East Douglas Herd Management Area (PEDHMA), where BLM expects to only be able to gather 80 percent of the wild horses during gather operations. Population modeling was completed for all alternatives including the No Action. Initial population age structures that were utilized computed a stable age-sex distribution with the initial population size of 838 (the current minimum estimated population of the PEDHMA). The percentages for females/males in the stable population used in the model were approximately 46 percent females and 54 percent males, based on studies in the Garfield Flat HMA. All simulations used the survival probabilities and foaling rates supplied with the WinEquus population model for the Garfield Flat HMA. Survival data was collected by M. Ashley and S. Jenkins at Garfield Flat, Nevada between 1993 and 1999. Marked individuals were followed for a total of 708 animal-years to generate these survival probabilities. Foaling rate data was collected by M. Ashley and S. Jenkins at Garfield Flat, Nevada between 1993 and 1999. Marked females were followed for a total of 351 animal-years to generate these data on foaling rates.

These initial populations for the PEDHMA were entered into the model and put through simulations that included Gather to Low End of AML and Fertility Control Treatment (Alternative A), Gather to Low End of AML and Do Not Use Fertility Control Treatments (Alternative B), and No Action Alternative (Alternative C). Gate cut was also used to represent removing as many animals as possible from the PEDHMA to reach AML. The gate cut component does not represent what may occur on the ground as selective removal criteria may be utilized to reach AML to retain desirable characteristics in the PEDHMA over the long term. One additional difficulty with the model is that it does not have the ability to estimate the effectiveness of GonaCon-Equine as the preferred fertility control treatment. GonaCon-Equine could have longer lasting fertility control effects within the population after booster doses are given, which could increase the time that the PEDHMA stays within the AML. The simulations were run for 100 trials for the eleven years. For each simulation, a series of graphs and tables were provided which included the “most typical” trial, population sizes, growth rates, and gather numbers.

## F.2. Results of Population Modeling

Out of the 100 trials in each simulation run, the model tabulated minimum, average, and maximum population sizes. The model was run for a period of eleven years from 2020 to 2030 and gives output through 2030. These numbers are useful to make relative comparisons of the different alternatives, and potential outcomes under different management options. The lowest, median and highest trials are displayed for each simulation completed. This output, together with the time series and most typical trial graphs are useful representations of the results of the program in terms of assessing the effects of the management alternatives because it shows not only expected average results but also extreme results that might be possible. The minimum population size in general reflects the numbers that would remain following management or random environmental impacts. The maximum population size generally reflects the population that existed prior to the gather, and in many cases that figure would not be exceeded during the ten years of the simulations. Half of the trials were greater than the median and half of them less than the median.

Under Table 1 and 2 below, the model depicts in population numbers that there is only a marginal difference, but what it does not show is that with gather operations and the use of fertility control treatments that the real difference, besides the frequency of gather operations necessary to stay within AML, is that a lower number of wild horses would need to be gathered and removed in order to stay within AML. So overall there is a benefit to the successful utilization of fertility control treatments in the PEDHMA.

**Table 1. Population Size – Gather to Low End of AML and Fertility Control Treatment (Alternative A)**

| Estimated Population Sizes in 11 Years | | | |
|---|---|---|---|
| **Trial** | **Minimum** | **Average** | **Maximum** |
| Lowest | 120 | 263 | 843 |
| Median | 152 | 284 | 906 |
| Highest | 175 | 333 | 1,145 |

**Table 2. Population Size – Gather to Low End of AML and Do Not Use Fertility Control Treatments (Alternative B)**

| Estimated Population Sizes in 11 Years | | | |
|---|---|---|---|
| **Trial** | **Minimum** | **Average** | **Maximum** |
| Lowest | 121 | 260 | 843 |
| Median | 155 | 284 | 912 |
| Highest | 182 | 339 | 1,163 |

**Table 3. Population Size – No Action Alternative (Alternative C)**

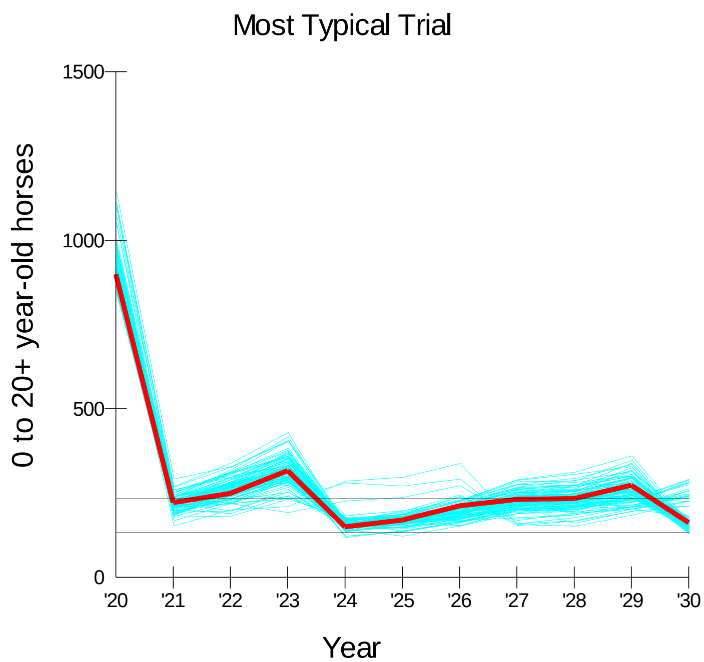
| *Estimated Population Sizes in 10 Years versus 11 Years | | | |
|---|---|---|---|
| **Trial** | **Minimum** | **Average** | **Maximum** |
| Lowest | 842 | 1,698 | 3,124 |
| Median | 924 | 2,635 | 5,586 |
| Highest | 1,176 | 3,503 | 8,311 |

### *F.2.1. Time Series Graph of Most Typical Trial*

Based on the results from the model, spaghetti graphs (see below) were generated for each simulation. These graphs show how population size changes over time. The Y-axis scale remains constant for each graph; however, the X-axis was determined based on results and was unable to be changed. At first glance, there appears to be not much difference between the trials, but if the reader takes a closer look one finds the scales to be different.

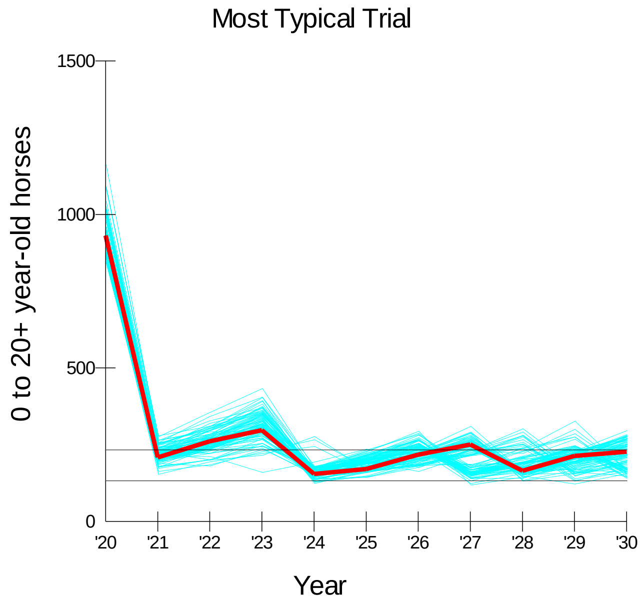
Each line represents one of the 100 trials for the simulations completed for each alternative. The two horizontal lines located in the graphs represent the threshold for gather (upper range of AML) and the target population size (low range of AML). The Most Typical Trial graph includes a dark heavy line (red) which represents what the model has chosen as the trial with the most typical results. This trial closely matches the average of all 100 trials. The most typical trial is useful for making comparisons between alternatives, and for predicting what would be the probable results of the action.

**Alternative A: Gather to Low End of AML and Fertility Control Treatment**



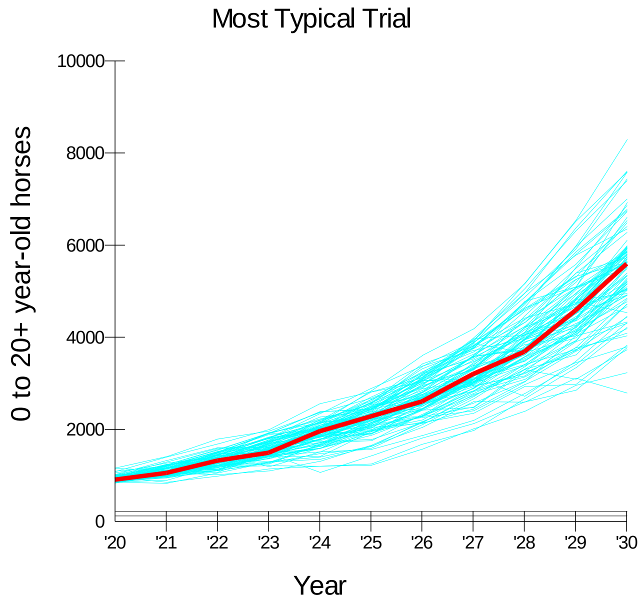

The results of the modeling for Alternative A indicate that following a 2020 (program default) gather with fertility control that the average population between 2020 and 2030 on a four-year cycle would begin to be near AML in 2021 and be within AML by 2024 (gather in 2024) following the 2020 subsequent gather operation and then would stay within AML until approximately 2029. This could potentially make for adjustments in future gather operations and fertility control treatments. This model illustrates that implementing gather and removal simultaneously with fertility control, that the PEDHMA could reach low end of AML within four years and maintain the population within AML for up to 5 years following the 2024 gather operation.

**Alternative B: Gather to Low End of AML and Do Not Use Fertility Control Treatments**




The results of the modeling under Alternative B indicate that when the low end of AML (135) remains in the PEDHMA following the initial gather, that the average population would not go over the upper end of the AML until around the year 2023 (four-year cycle) but under the modeling another gather would have to take place in order to bring the PEDHMA back down to the low end of AML. The model indicates that AML can be achieved without fertility control, however reaching the low end of the AML is necessary during each gather (completed every four years) without the use of fertility control and the number of wild horses that would need to be gathered and removed at each gather operation would be higher than for Alternative A.

**Alternative C: No Action Alternative**




Population modeling was completed for the No Action Alternative. The most typical trial was utilized to demonstrate the projected population over time if a gather does not take place. The graph of most typical trial for the gather area is displayed below as a comparison only. The graph clearly shows the continued increase in population size if a gather is not completed.

## *F.2.2. Growth Rates*

Through the model, average population growth rates were obtained for Alternative A (Gather to Low End of AML and Fertility Control Treatment) and Alternative B (Gather to Low End of AML and Do Not Use Fertility Control Treatments) and Alternative C (No Action) out of 100 trials. Growth rates are displayed for the lowest, median and highest trial.

**Table 4. HMA - Percent Average Growth Rates in 11 years**

| Trial | Alternative A: Gather + Fertility Control | Alternative B: Gather Only | Alternative C: No Gather |
|---|---|---|---|
| Lowest | 9.2 | 13.0 | 14.6 |
| Median | 14.6 | 19.3 | 19.3 |
| Highest | 21.9 | 25.9 | 24.2 |

Population modeling data reflects that the implementation of fertility control treatments could result in reduced growth rate of the wild horse population within the PEDHMA. Growth rate analyzed for the fertility control treatment alternative were lower than when fertility control treatment was not implemented. The model also indicates that growth rates would not be so low as to cause risk to the population, should fertility control treatments be implemented.

## *F.2.3. Population Modeling Summary*

To summarize the results obtained by simulating the range of alternatives for the PEDHMA wild horse gather, the following questions can be addressed.

- *Do any of the Alternatives "crash" the population?*
  None of the alternatives indicate that a crash is likely to occur to the population. Minimum population levels and growth rates are all within reasonable levels, and adverse impacts to the population are not likely.

- *What effect does fertility control have on population growth rate?*
  As expected, the alternative implementing fertility control (Alternative A) reflects the lowest overall growth rates. The growth rates for the PEDHMA proposed for fertility control are lower than the non-fertility control growth rates.

- *What effect do the different alternatives have on the average population size?*
  Based on the average median population trial obtained through the population model for the No Action Alternative the herd size would be 2,635 (Alternative C), for the removal only alternative the herd size would be 284 (Alternative B), and for the removal with fertility control treatment alternative the herd size would be 284 (Alternative A), with a possibility of reduced frequency of gather operations and number of wild horses to be gathered and removed depending on effectiveness in application and duration of GonaCon (fertility control treatment preference) within the population.

The No Action Alternative is unacceptable; however, it was analyzed for comparison with the other alternatives. Without wild horse gather operation the population has the potentially to double approximately every four years.

# APPENDIX G. SCIENTIFIC LITERATURE REVIEW

This appendix includes scientific literature reviews addressing five topics: effects of gathers, effects of wild horses and burros on rangeland ecosystems, effects of fertility control vaccines and sex ratio manipulations, effects of sterilization, and effects of intrauterine devices (IUDs). This review was updated in January 2021 to reflect newly available studies.

## G.1. 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 the animals held 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 three 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).

Transport, Off-range Corrals, and Adoption Preparation: All gathered wild horses would be removed and transported to BLM holding facilities where they would be inspected by facility staff and if needed a contract veterinarian to observe health and ensure the animals are being humanely cared for. Those wild horses that are removed from the range and are identified to not return to the range would be transported to the receiving off-range corrals (ORC) 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 veterinarian provides recommendations to the BLM regarding care, treatment, and if necessary, euthanasia of the recently captured wild horses. Wild horses in very thin condition or animals with injuries are sorted and placed in hospital pens, fed separately, and/or treated for their injuries.

After recently captured wild horses have transitioned to their new environment, they are prepared for adoption, sale, or transport to Off-Range pastures. Preparation involves freeze-marking the animals with a unique identification number, vaccination against common diseases, castration, microchipping and de-worming. At ORC facilities, a minimum of 700 square feet of space is provided per animal.

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

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

Off-Range Pastures: When shipping wild horses for adoption, sale, or Off-Range Pastures (ORPs) the animals may be transported for up to a maximum of 24 hours. Immediately prior to transportation, and after every 24 hours of transportation, animals are offloaded and provided a minimum of 8 hours onthe-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, healthy excess wild horses can be euthanized or sold without limitation if there is no adoption demand for the animals. However, while euthanasia and sale without limitation are allowed under the statute, these activities have not been permitted under Congressional appropriations for over a decade. If Congress were to lift the current appropriations restrictions, then it is possible that excess horses removed from the Confusion HMA over the next 10 years could potentially be euthanized or sold without limitation consistent with the provisions of the WFRHBA. Any old, sick, or lame horses unable to maintain an acceptable body condition (greater than or equal to a Henneke BCS of 3) or with serious physical defects would be humanely euthanized either before gather activities begin or during the gather operations. Decisions to humanely euthanize animals in field situations would be made in conformance with BLM policy (Washington Office Instruction Memorandum (WO IM) 2015-070 or most current edition).

**Helicopter**

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

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

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

### Bait/Water Trapping

Bait and/or water trapping may be used if circumstances require it or best fits the management action to be taken. Bait and/or water trapping generally require a longer window of time for success than helicopter drive trapping. Although the trap would be set in a high probability area for capturing excess wild horses residing within the area, and at the most effective time periods, time is required for the horses to acclimate to the trap and/or decide to access the water/bait.

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

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

Gathering excess horses using bait/water trapping could occur at any time of the year and traps would remain in place until the target number of animals are removed. Generally, bait/water trapping is most effective when a specific resource is limited, such as water during the summer months. For example, in some areas, a group of wild horses may congregate at a given watering site during the summer because few perennial water resources are available nearby. Under those circumstances, water trapping could be a useful means of reducing the number of horses at a given location, which can also relieve the resource pressure caused by too many horses. As the proposed bait and/or water trapping in this area is a low stress approach to gathering wild horses, such trapping can continue into the foaling season without harming the mares or foals.

### Gather Related Temporary Holding Facilities (Corrals)

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

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

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

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

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

After recently captured wild horses have transitioned to their new environment, they are prepared for adoption, sale, or transport to Off-Range pastures. Preparation involves freeze-marking the animals with a unique identification number, vaccination against common diseases, castration, and de-worming. At ORC facilities, a minimum of 700 square feet of space is provided per animal.

**Adoption**

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

**Sale with Limitations**

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

**Off-Range Pastures**

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

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

**Euthanasia or Sale without Limitations**

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

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

**Public Viewing Opportunities**

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

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## G.2. 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.

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 an estimated 81,951 BLM-administered wild horses and burros as of March 1, 2018, which does not include foals born in 2018. 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). For the majority of wild horse herds, there is little overall evidence that population growth is significantly affected by predation. 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.

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 2020). 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). 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 non-native 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).

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).

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## G.3. 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.

### *G.3.1. 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 cross-react with tissues outside of the reproductive system (Barber and Fayrer-Hosken 2000).

Research has demonstrated that contraceptive efficacy of an injected liquid PZP vaccine, such as ZonaStat-H, is approximately 90% 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 seven 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 led 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

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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 severity of weather 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. 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 need to be considered. Kirkpatrick et al. (2010) concluded that: "the larger question is, even if subtle alterations in behavior may occur, this is still far better than the alternative," and that the "…other victory for horses is that every mare prevented

> from being removed, by virtue of contraception, is a mare that will only be delaying her reproduction rather than being eliminated permanently from the range. This preserves herd genetics, while gathers and adoption do not."

The 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 in 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.

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## G.4. Effects of Sterilzation, Including Spaying and Neutering

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). Population growth suppression becomes less expensive if fertility control is long-lasting (Hobbs et al. 2000), such as with sterilization methods that may include spaying and neutering. Sterilizing a female horse (mare) or burro (jenny) can be accomplished by several methods, some fo which are surgical and others of which are non-surgical. In this review, ‘spaying’ is defined to be surgical sterilization, usually accomplished by removal of the ovaries, but other surgical methods such as tubal ligation that led to sterility may also be considered a form of spaying. Unlike in dog and cat spaying, spaying a horse or burro does not entail removal of the uterus. Here, ‘neutering’ is defined to be the sterilization of a male horse (stallion) or burro (jack), either by removal of the testicles (castration, also known as gelding) or by vasectomy, where the testicles are retained but no sperm leave the body by severing or blocking the vas deferens or epididymis.

In the context of BLM wild horse and burro management, sterilization is expected to be successful to the extent that it reduces the number of reproducing females. By definition, sterilizing a given female is 100% effective as a fertility control method for that female. Neutering males may be effective in one of two ways. First, neutered males may continue to guard fertile females, preventing the females from breeding with fertile males. Second, if neutered males are included in a herd that has a high male-to-female sex ratio, then the neutered males may comprise some of the animals within the appropriate management level (AML) of that herd, which would effectively reduce the number of females in the herd. Although these and other 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).

Peer-reviewed scientific literature details the expected impacts of sterilization methods on wild horses and burros. No finding of excess animals is required for BLM to pursue sterilization 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 female sterilization, then neuter use in males. This review does not examine effects of reversible fertility control vaccines. 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 at the herd level are generally transient. The principle impact to individuals treated is sterility, which is the intended outcome. Sterilization 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 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.

Discussions about herds that are 'non-reproducing' in whole or in part are in the context of this 'metapopulation' structure, where self-sustaining herds are not necessarily at the scale of single HMAs. So long as the definition of what constitutes a self-sustaining herd includes the larger set of HMAs that have past or ongoing demographic and genetic connections – as is recommended by the NAS 2013 report – it is clear that single HMAs can be managed as non-reproducing in whole or in part while still allowing for a self-sustaining population of wild horses or burros at the broader spatial scale. Wild horses are not an endangered species (USFWS 2015), nor are they rare. Nearly 67,000 adult wild horses and nearly 15,000 adult wild burros roam BLM lands as of March 1, 2018, and those numbers do not include at least 10,000 WH&B on US Forest Service lands, and at least 50,000 feral horses on tribal lands in the Western United States.

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 methods alone do not remove excess horses from an HMA's population, so one or more gathers are usually needed 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), spaying and neutering are not very effective at reducing population growth rates to the point where births equal deaths in a herd. However, even modest levels of fertility control activities can reduce the frequency of horse gather activities, and costs to taxpayers. Population growth suppression becomes less expensive if fertility control is long-lasting (Hobbs et al. 2000), such as with sterilization. Because sterilizing animals 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.

## Effects of handling and marking

Surgical sterilization techniques, while not reversible, may control horse reproduction without the kind of additional handling or darting that can be needed to administer contraceptive vaccines. In this sense, sterilization surgeries can be used to achieve herd management objectives with a relative minimum level of animal handling and management over the long term. The WFRHBA (as amended) indicates that management should be at the minimum level necessary to achieve management objectives (CFR 4710.4), and if gelding some fraction of a managed population can reduce population growth rates by replacing breeding mares, it then follows that spaying or neutering some individuals can lead to a reduced number of handling occasions and removals of excess horses from the range, which is consistent with legal guidelines. Other fertility control options that may be temporarily effective on male horses, such as the injection of GonaCon-Equine immunocontraceptive vaccine, apparently require multiple handling occasions to achieve longer-term male infertility. Similarly, some formulations of PZP immunocontraception that is currently available for use in female wild horses and burros require handling or darting every year (though longer-term effects may result after 4 or more treatments; Nuñez et al. 2017). By some measures, any management activities that require multiple capture operations to treat a given individual would be more intrusive for wild horses and potentially less sustainable than an activity that requires only one handling occasion.

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

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

Observations of the long-term outcomes of sterilization may be recorded during routine resource monitoring work. Such observations could include but not be limited to band size, social interactions with other geldings and harem bands, distribution within their habitat, forage utilization and activities around key water sources. Periodic population inventories and future gather statistics could provide additional anecdotal information.

### *G.4.1. Neutering Males*

Castration (the surgical removal of the testicles, also called gelding or neutering) is a surgical procedure for the horse sterilization that has been used for millennia. Vasectomy involves severing or blocking the vas deferens or epididymis, to prevent sperm from being ejaculated. The procedures are fairly straight forward and has a relatively low complication rate. As noted in the review of scientific literature that follows, the expected effects of gelding and vasectomy are well understood overall, even though there is some degree of uncertainty about the exact quantitative outcomes for any given individual (as is true for any natural system).

Including a portion of neutered males in a herd can lead to a reduced population-level per-capita growth rate if they cause a marginal decrease in female fertility or if the neutered males take some of the places that would otherwise be occupied by fertile females. By having a skewed sex ratio with fewer females than males (fertile stallions plus neutered males), the result will be that there will be a lower number of breeding females in the population. Including neutered males in herd management is not new for BLM and federal land management. Geldings have been released on BLM lands as a part of herd management in the Barren Valley complex in Oregon (BLM 2011), the Challis HMA in Idaho (BLM 2012), and the Conger HMA in Utah (BLM 2016). Vasectomized males and geldings were also included in US Fish and Wildlife Service management plans for the Sheldon National Wildlife Refuge that relied on sterilization and removals (Collins and Kasbohm 2016). Taking into consideration the literature available at the time, the National Academies of Sciences concluded in their 2013 report that a form of vasectomy was one of the three most promising methods for WH&B fertility control (NAS 2013).

Nelson (1980) and Garrott and Siniff (1992) modeled potential efficacy of male-oriented contraception as a population management tool, and both studies agreed that while slowing growth, sterilizing only dominant males (i.e., harem-holding stallions) would result in only marginal reduction in female fertility rates. Eagle et al. (1993) and Asa (1999) tested this hypothesis on HMAs where dominant males were vasectomized. Their findings agreed with modeling results from previous studies, and they also concluded that sterilizing only dominant males would not provide the desired reduction in female fertility and overall population growth rate, assuming that the numbers of fertile females is not changed. While bands with vasectomized harem stallions tended to have fewer foals, breeding by bachelors and subordinate stallions meant that population growth still occurred – female fertility was not dramatically reduced. Collins and Kasbohm (2016) demonstrated that there was a reduced fertility rate in a feral horse herd with both spayed and vasectomized horses – some geldings were also present in that herd. Garrott and Siniff (1992) concluded from their modeling that male sterilization would effectively cause there to be zero population growth (the point where births roughly equal deaths) only if a large proportion of males (i.e., >85%) could be sterilized. In cases where the goal of harem stallion sterilization is to reduce population growth rates, success appears to be dependent on a stable group structure, as strong bonds between a stallion and mares reduce the probability of a mare mating an extra-group stallion (Nelson 1980, Garrott and Siniff 1992, Eagle et al. 1993, Asa 1999).

Despite these studies, neutered males can be used to reduce overall growth rates in a management strategy that does not rely on any expectation that geldings will retain harems or lead to a reduction in per-female fertility rates. The primary goal of including neutered males in a herd need not necessarily be to reduce female fertility (although that may be one result). Rather, by including some neutered males in a herd that also has fertile mares and stallions, the neutered males would take some of the spaces toward AML that would otherwise be taken by fertile females. If the total number of horses is constant but neutered males are included in the herd, this can reduce the number of fertile mares, therefore reducing the absolute number of foals produced. Put another way, if neutered males occupy spaces toward AML that would otherwise be filled by fertile mares, that will reduce growth rates merely by the fact of causing there to be a lower starting number of fertile mares.

## Direct Effects of Neutering

No animals which appear to be distressed, injured, or in poor health or condition would be selected for gelding. Stallions would not typically be neutered within 72 hours of capture. The surgery would be performed by a veterinarian using general anesthesia and appropriate surgical techniques. The final determination of which specific animals would be gelded would be based on the professional opinion of the attending veterinarian in consultation with the Authorized Officer (i.e., See the SOPs for neutering in the Antelope / Triple B gather EA, DOI-BLM-NV-E030-2017-010-EA).

Though neutering males is a common surgical procedure, especially gelding, some level of minor complications after surgery may be expected (Getman 2009), and it is not always possible to predict when postoperative complications would occur. Fortunately, the most common complications are almost always self-limiting, resolving with time and exercise. Individual impacts to the stallions during and following the gelding process should be minimal and would mostly involve localized swelling and bleeding. Complications may include, but are not limited to: minor bleeding, swelling, inflammation, edema, infection, peritonitis, hydrocele, penile damage, excessive hemorrhage, and eventration (Schumacher 1996, Searle et al. 1999, Getman 2009). A small amount of bleeding is normal and generally subsides quickly, within 2-4 hours following the procedure. Some degree of swelling is normal, including swelling of the prepuce and scrotum, usually peaking between 3-6 days after surgery (Searle et al. 1999). Swelling should be minimized through the daily movements (exercise) of the horse during travel to and from foraging and watering areas. Most cases of minor swelling should be back to normal within 5-7 days, more serious cases of moderate to severe swelling are also self-limiting and are expected to resolve with exercise after one to 2 weeks. Older horses are reported to be at greater risk of post-operative edema, but daily exercise can prevent premature closure of the incision and prevent fluid buildup (Getman 2009). In some cases, a hydrocele (accumulation of sterile fluid) may develop over months or years (Searle et al. 1999). Serious complications (eventration, anesthetic reaction, injuries during handling, etc.) that result in euthanasia or mortality during and following surgery are rare (e.g., eventration rate of 0.2% to 2.6% noted in Getman 2009, but eventration rate of 4.8% noted in Shoemaker et al. 2004) and vary according to the population of horses being treated (Getman 2009). Normally one would expect serious complications in less than 5% of horses operated under general anesthesia, but in some populations these rates have been as high as 12% (Shoemaker 2004). Serious complications are generally noted within 3 or 4 hours of surgery but may occur any time within the first week following surgery (Searle et al. 1999). If they occur, they would be treated with surgical intervention when possible, or with euthanasia when there is a poor prognosis for recovery. Vasectomized stallions may remain fertile for up to 6 weeks after surgery, so it is optimal if that treatment occurs well in advance of the season of mare fertility starting in the spring (NAS 2013). The NAS report (2013) suggested that chemical vasectomy, which has been developed for dogs and cats, may be appropriate for wild horses and burros.

For intact stallions, testosterone levels appear to vary as a function of age, season, and harem size (Khalil et al 1998). It is expected that testosterone levels will decline over time after castration. Testosterone levels should not change due to vasectomy. Vasectomized stallions should retain their previous levels of libido. Domestic geldings had a significant prolactin response to sexual stimulation but lacked the cortisol response present in stallions (Colborn et al.

1991). Although libido and the ability to ejaculate tends to be gradually lost after castration (Thompson et al. 1980), some geldings continue to mount mares and intromit (Rios and Houpt 1995, Schumacher 2006).

## Indirect Effects of Neutering

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

Depending on whether an HMA is non-reproducing in whole or in part, reproductive stallions may or may not still be a component of the population's age and sex structure. The question of whether a given neutered male would or would not attempt to maintain a harem is not germane to population-level management. It is worth noting, though, that the BLM is not required to manage populations of wild horses in a manner that ensures that any given individual maintains its social standing within any given harem or band. Neutering a subset of stallions would not prevent other fertile stallions and mares from continuing with the typical range of social behaviors for sexually active adults. For fertility control strategies where gelding is intended to reduce growth rates by virtue of sterile males defending harems, the NAS (2013) suggested that the effectiveness of gelding on overall reproductive rates may depend on the pre-castration social roles of those animals. Having a post-gather herd with some neutered males and a lower fraction of fertile mares necessarily reduces the absolute number of foals born per year, compared to a herd that includes more fertile mares. An additional benefit is that geldings that would otherwise be permanently removed from the range (for adoption, sale or other disposition) may be released back onto the range where they can engage in free-roaming behaviors.

## Behavioral Effects of Neutering

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

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

Vasectomized males continue to attempt to defend or gain breeding access to females. It is generally expected that vasectomized WH&B will continue to behave like fertile males, given that the only physiological change in their condition is a lack of sperm in their ejaculate. If a vasectomized stallion retains a harem, the females in the harem will continue to cycle until they are fertilized by another stallion, or until the end of the breeding season. As a result, the vasectomized stallion may be involved in more aggressive behaviors to other males through the entire breeding season (Asa 1999), which may divert time from foraging and cause him to be in poorer body condition going into winter. Ultimately, this may lead to the stallion losing control of a given harem. A feral horse herd with high numbers of vasectomized stallions retained typical harem social structure (Collins and Kasbohm 2016). Again, it is worth noting that the BLM is not required to manage populations of wild horses in a manner that ensures that any given individual maintains its social standing within any given harem or band.

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

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

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

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

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

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

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

### *G.4.2. Mare Sterilization*

Surgical sterilization (spaying mares by removing a mare’s ovaries), via colpotomy, has been an established veterinary technique since 1903 (Loesch and Rodgerson 2003, NAS 2013). Spaying via colpotomy has the advantage of not leaving any external wound that could become infected. For this reason, it has been identified as a good choice for sterilization of feral or wild mares (Rowland et al. 2018). The procedure has a relatively low complication rate, although post-surgical mortality and morbidity are possible, as with any surgery. Herd-level birth rate is expected to decline in direct proportion to the fraction of spayed mares in the herd because spayed mares cannot become pregnant. Spaying mares has already been shown to be an effective part of feral horse management that reduced herd growth rates on federal lands (Collins and Kasbohm 2016).

#### Current Methods of Sterilization

This literature review of mare sterilization impacts focuses on 4 methods: spaying via flank laparoscopy, spaying via colpotomy, non-surgical physical sterilization, and pharmacological or immunocontraceptive sterilization. The anticipated effects are both physical and behavioral. Physical effects of surgical methods would be due to post-treatment healing and the possibility for complications.

Colpotomy is a surgical technique in which there is no external incision, reducing susceptibility to infection. For this reason, ovariectomy via colpotomy has been identified as a good choice for feral or wild horses (Rowland et al. 2018). Ovariectomy via colpotomy is a relatively short surgery, with a relatively quick expected recovery time. In 1903, Williams first described a vaginal approach, or colpotomy, using an ecraseur to ovariectomize mares (Loesch and Rodgerson 2003). The ovariectomy via colpotomy procedure has been conducted for over 100 years, normally on open (non-pregnant), domestic mares. It is expected that the surgeon should be able to access ovaries with ease in mares that are in the early- or mid-stage of pregnancy. The anticipated risks associated with the pregnancy are described below. When wild horses are gathered or trapped for fertility control treatment there would likely be mares in various stages of gestation. Removal of the ovaries is permanent and 100 percent effective, however the procedure is not without risk.

Flank laparoscopy (Lee and Hendrickson 2008, Devick et al. 2018, Easley et al. 2018) is commonly used in domestic horses for application in mares due to its minimal invasiveness and full observation of the operative field. Ovariectomy via flank laparoscopy was seen as the lowest risk method considered by a panel of expert reviewers convened by USGS (Bowen 2015). In a review of unilateral and bilateral laparoscopic ovariectomy on 157 mares, Röcken et al. (2011) found that 10.8% of mares had minor post-surgical complications and recorded no mortality. Mortality due to this type of surgery, or post-surgical complications, is not expected, but is a possibility. In two studies, ovariectomy by laparoscopy or endoscope-assisted colpotomy did not cause mares to lose weight, and there was no need for rescue analgesia following surgery (Pader et al. 2011, Bertin et al. 2013). This surgical approach entails three small incisions on the animal's flank, through which three cannulae (tubes) allow entry of narrow devices to enter the body cavity: these are the insufflator, endoscope, and surgical instrument. The surgical procedure involves the use of narrow instruments introduced into the abdomen via cannulas for the purpose of transecting or sealing (Easley 2018) the ovarian pedicle, but the insufflation should allow the veterinarian to navigate inside the abdomen without damaging other internal organs. The insufflator blows air into the cavity to increase the operating space between organs, and the endoscope provides a video feed to visualize the operation of the surgical instrument. This procedure can require a relatively long duration of surgery but tends to lead to the lowest post-operative rates of complications. Flank laparoscopy may leave three small (<5 cm) visible scars on one side of the horse's flank, but even in performance horses these scars are considered minimal. It is expected that the tissues and musculature under the skin at the site of the incisions in the flank will heal quickly, leaving no long-lasting effects on horse health. Monitoring for up to two weeks at the facility where surgeries take place will allow for veterinary inspection of wound healing. The ovaries may be dropped into the abdomen, but this is not expected to cause any health problem; it is usually done in ovariectomies in cattle (e.g., the Willis Dropped Ovary Technique) and Shoemaker et al. (2014) found no problems with revascularization or necrosis in a study of young horses using this method.

Non-surgical, physical sterilization would include any physical form of sterilization that does not involve surgery. This could include any form of physical procedure that leads a mare to be unable to become pregnant, or to maintain a pregnancy. For example, one form of physical, non-surgical sterilization causes a long-term blockage of the oviduct, so that fertile eggs cannot go from the ovaries to the uterus. One form of this procedure infuses medical cyanoacrylate glue into the oviduct to cause long-term blockage (Bigolin et al. 2009). Treated mares would need to be screened to ensure they are not pregnant. The procedure is transcervical, so the treated mare cannot have a fetus in the uterus at the time of treatment. The mare would be sterile, although she would continue to have estrus cycles.

Pharmacological or immunocontraceptive sterilization methods would use an as-yet undetermined drug or vaccine to cause sterilization. At this time, BLM has not yet identified a pharmacological or immunocontraceptive method to sterilize mares that has been proven to reliably and humanely sterilize wild horse mares. However, there is the possibility that future development and testing of new methods could make an injectable sterilant available for wild horse mares. Analyses of the effects of having sterile mares as a part of a wild horse herd, such as due to surgical sterilization, would likely be applicable to non-surgical methods as well.

## Effects of Spaying on Pregnancy and Foal

The average mare gestation period ranges from 335 to 340 days (Evans et al. 1977, p. 373). There are few peer reviewed studies documenting the effects of ovariectomy on the success of pregnancy in a mare. A National Research Council of the National Academies of Sciences (NAS) committee that reviewed research proposals in 2015 explained, "The mare's ovaries and their production of progesterone are required during the first 70 days of pregnancy to maintain the pregnancy" (NAS 2015). In female mammals, less progesterone is produced when ovaries are removed, but production does not cease (Webley and Johnson 1982). In 1977, Evans et al. stated that by 200 days, the secretion of progesterone by the corpora lutea is insignificant because removal of the ovaries does not result in abortion (p. 376). "If this procedure were performed in the first 120 days of pregnancy, the fetus would be resorbed or aborted by the mother. If performed after 120 days, the pregnancy should be maintained. The effect of ovary removal on a pregnancy at 90–120 days of gestation is unpredictable because it is during this stage of gestation that the transition from corpus luteum to placental support typically occurs" (NAS 2015). In 1979, Holtan et al. evaluated the effects of bilateral ovariectomy at selected times between 25 and 210 days of gestation on 50 mature pony mares. Their results show that abortion (resorption) of the conceptus (fetus) occurred in all 14 mares ovariectomized before day 50 of gestation, that pregnancy was maintained in 11 of 20 mares after ovariectomy between days 50 and 70, and that pregnancy was not interrupted in any of 12 mares ovariectomized on days 140 to 210. Those results are similar to the suggestions of the NAS committee (2015).

For those pregnancies that are maintained following the procedure, likely those past approximately 120 days, the development of the foal is not expected to be affected. However, because this procedure is not commonly conducted on pregnant mares the rate of complications to the fetus has not yet been quantified. There is the possibility that entry to the abdominal cavity could cause premature births related to inflammation. However, after five months the placenta should hormonally support the pregnancy regardless of the presence or absence of ovaries. Gestation length was similar between ovariectomized and control mares (Holtan et al. 1979).

## Direct Effects of Spaying

Between 2009 and 2011, the Sheldon NWR in Nevada conducted ovariectomy via colpotomy surgeries (August through October) on 114 feral mares and released them back to the range with a mixture of sterilized stallions and untreated mares and stallions (Collins and Kasbohm 2016). Gestational stage was not recorded, but a majority of the mares were pregnant (Gail Collins, US Fish and Wildlife Service (USFWS), pers. comm.). Only a small number of mares were very close to full term. Those mares with late term pregnancies did not receive surgery as the veterinarian could not get good access to the ovaries due to the position of the foal (Gail Collins, USFWS, pers. comm.). After holding the mares for an average of 8 days after surgery for observation, they were returned to the range with other treated and untreated mares and stallions (Collins and Kasbohm 2016). During holding the only complications were observed within 2 days of surgery. The observed mortality rate for ovariectomized mares following the procedure was less than 2 percent (Collins and Kasbohm 2016, Pielstick pers. comm.).

During the Sheldon NWR ovariectomy study, mares generally walked out of the chute and started to eat; some would raise their tail and act as if they were defecating; however, in most mares one could not notice signs of discomfort (Bowen 2015). In their discussion of ovariectomy via colpotomy, McKinnon and Vasey (2007) considered the procedure safe and efficacious in many instances, able to be performed expediently by personnel experienced with examination of the female reproductive tract, and associated with a complication rate that is similar to or less than male castration. Nevertheless, all surgery is associated with some risk. Loesch et al. (2003) lists that following potential risks with colpotomy: pain and discomfort; injuries to the cervix, bladder, or a segment of bowel; delayed vaginal healing; eventration of the bowel; incisional site hematoma; intraabdominal adhesions to the vagina; and chronic lumbar or bilateral hind limb pain. Most horses, however, tolerate ovariectomy via colpotomy with very few complications, including feral horses (Collins and Kasbohm 2016). Evisceration is also a possibility, but these complications are considered rare (Prado and Schumacher, 2017). Mortality due to surgery or post-surgical complications is not anticipated, but it is a possibility and therefore every effort would be made to mitigate risks.

In September 2015, the BLM solicited the USGS to convene a panel of veterinary experts to assess the relative merits and drawbacks of several surgical ovariectomy techniques that are commonly used in domestic horses for potential application in wild horses. A table summarizing the various methods was sent to the BLM (Bowen 2015) and provides a concise comparison of several methods. Of these, ovariectomy via colpotomy was found to be relatively safe when practiced by an experienced surgeon and was associated with the shortest duration of potential complications after the operation. The panel discussed the potential for evisceration through the vaginal incision with this procedure. In marked contrast to a suggestion by the NAS report (2013), this panel of veterinarians identified evisceration as not being a probable risk associated with ovariectomy via colpotomy and "none of the panel participants had had this occur nor had heard of it actually occurring" (Bowen 2015).

Most spay surgeries on mares have low morbidity and with the help of medications, pain and discomfort can be mitigated. Pain management is an important aspect of any ovariectomy (Rowland et al. 2018); according to surgical protocols that would be used, a long-lasting direct anesthetic would be applied to the ovarian pedicle, and systemic analgesics in the form of butorphanol and flunixin meglumine would be administered, as is compatible with accepted animal husbandry practices. In a study of the effects of bilateral ovariectomy via colpotomy on 23 mares, Hooper and others (1993) reported that postoperative problems were minimal (1 in 23, or 4%). Hooper et al. (1993) noted that four other mares were reported by owners as having some problems after surgery, but that evidence as to the role the surgery played in those subsequent problems was inconclusive. In contrast Röcken et al. (2011) noted a morbidity of 10.8% for mares that were ovariectomized via a flank laparoscopy. "Although 5 mares in our study had problems (repeated colic in 2 mares, signs of lumbar pain in 1 mare, signs of bilateral hind limb pain in 1 mare, and clinical signs of peritonitis in 1 mare) after surgery, evidence is inconclusive in each as to the role played by surgery" (Hooper et al. 1993). A recent study showed a 2.5% complication rate where one mare of 39 showed signs of moderate colic after laparoscopic ovariectomy (Devick 2018 personal communication).

## Behavioral Effects of Mare Sterilization

No fertility control method exists that does not affect physiology or behavior of a mare (NAS 2013). Any action taken to alter the reproductive capacity of an individual has the potential to affect hormone production and therefore behavioral interactions and ultimately population dynamics in unforeseen ways (Ransom et al. 2014). The health and behavioral effects of spaying wild horse mares that live with other fertile and infertile wild horses has not been well documented, but the literature review below can be used to make reasonable inferences about their likely behaviors.

Horses are anovulatory (do not ovulate/express estrous behavior) during the short days of late fall and early winter, beginning to ovulate as days lengthen and then cycling roughly every 21 days during the warmer months, with about 5 days of estrus (Asa et al. 1979, Crowell-Davis 2007). Estrus in mares is shown by increased frequency of proceptive behaviors: approaching and following the stallion, urinating, presenting the rear end, clitoral winking, and raising the tail towards the stallion (Asa et al. 1979, Crowell-Davis 2007). In most mammal species other than primates, estrus behavior is not shown during the anovulatory period, and reproductive behavior is considered extinguished following spaying (Hart and Eckstein 1997). However, mares may continue to demonstrate estrus behavior during the anovulatory period (Asa et al. 1980). Similarly, ovariectomized mares may also continue to exhibit estrous behavior (Scott and Kunze 1977, Kamm and Hendrickson 2007, Crabtree 2016), with one study finding that 30% of mares showed estrus signs at least once after surgery (Roessner et al 2015) and only 60 percent of ovariectomized mares cease estrous behavior following surgery (Loesch and Rodgerson 2003). Mares continue to show reproductive behavior following ovariectomy due to non-endocrine support of estrus behavior, specifically steroids from the adrenal cortex. Continuation of this behavior during the non-breeding season has the function of maintaining social cohesion within a horse group (Asa et al. 1980, Asa et al. 1984, NAS 2013). This may be a unique response of the horse (Bertin et al. 2013), as spaying usually greatly reduces female sexual behavior in companion animals (Hart and Eckstein 1997). In six ponies, mean monthly plasma luteinizing hormone levels in ovariectomized mares were similar to intact mares during the anestrous season, and during the breeding season were similar to levels in intact mares at mid-estrus (Garcia and Ginther 1976).

The likely effects of spaying on mares' social interactions and group membership can be inferred from available literature, even though wild horses have rarely been spayed and released back into the wild, resulting in few studies that have investigated their behavior in free-roaming populations. Wild horses and burros are instinctually herd-bound, and this behavior is expected to continue. Overall, the BLM anticipates that some spayed mares may continue to exhibit estrus behavior which could foster band cohesion. If free ranging ovariectomized mares show estrous behavior and occasionally allow copulation, interest of the stallion may be maintained, which could foster band cohesion (NAS 2013). This last statement could be validated by the observations of group associations on the Sheldon NWR where feral mares were ovariectomized via colpotomy and released back on to the range with untreated horses of both sexes (Collins and Kasbohm 2016). No data were collected on inter- or intra-band behavior (e.g. estrous display, increased tending by stallions, etc.), during multiple aerial surveys in years following treatment, all treated individuals appeared to maintain group associations, and there were no groups consisting only of treated males or only of treated females (Collins and Kasbohm 2016). In addition, of solitary animals documented during surveys, there were no observations of solitary treated females (Collins and Kasbohm 2016). These data help support the expectation that ovariectomized mares would not lose interest in or be cast out of the social dynamics of a wild horse herd. As noted by the NAS (2013), the ideal fertility control method would not eliminate sexual behavior or change social structure substantially.

A study conducted for 15 days in January 1978 (Asa et al. 1980), compared the sexual behavior in ovariectomized and seasonally anovulatory (intact) pony mares and found that there were no statistical differences between the two conditions for any measure of proceptivity or copulatory behavior, or days in estrous. This may explain why treated mares at Sheldon NWR continued to be accepted into harem bands; they may have been acting the same as a non-pregnant mare. Five to ten percent of pregnant mares exhibit estrous behavior (Crowell-Davis 2007). Although the physiological cause of this phenomenon is not fully understood (Crowell-Davis 2007), it is thought to be a bonding mechanism that assists in the maintenance of stable social groups of horses year-round (Ransom et al. 2014b). The complexity of social behaviors among free-roaming horses is not entirely centered on reproductive receptivity, and fertility control treatments that suppress the reproductive system and reproductive behaviors should contribute to minimal changes to social behavior (Ransom et al. 2014b, Collins and Kasbohm 2016).

BLM expects that wild horse harem structures would continue to exist under the proposed action because fertile mares, stallions, and their foals would continue to be a component of the herd. It is not expected that spaying a subset of mares would significantly change the social structure or herd demographics (age and sex ratios) of fertile wild horses.

'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.

## Indirect Effects of Mare sterilization

The free-roaming behavior of wild horses is not anticipated to be affected by mare sterilization, as the definition of free-roaming is the ability to move without restriction by fences or other barriers within a HMA (BLM H-4700-1, 2010) and there are no permanent physical barriers being proposed.

In domestic animals, spaying is often associated with weight gain and associated increase in body fat (Fettman et al 1997, Becket et al 2002, Jeusette et al. 2006, Belsito et al 2009, Reichler 2009, Camara et al. 2014). Spayed cats had a decrease in fasting metabolic rate, and spayed dogs had a decreased daily energy requirement, but both had increased appetite (O'Farrell & Peachey 1990, Hart and Eckstein 1997, Fettman et al. 1997, Jeusette et al. 2004). In wild horses, contracepted mares tend to be in better body condition that mares that are pregnant or that are nursing foals (Nuñez et al. 2010); the same improvement in body condition is likely to take place in spayed mares. In horses spaying has the potential to increase risk of equine metabolic syndrome (leading to obesity and laminitis), but both blood glucose and insulin levels were similar in mares before and after ovariectomy over the short-term (Bertin et al. 2013). In wild horses the quality and quantity of forage is unlikely to be sufficient to promote over-eating and obesity.

Coit et al. (2009) demonstrated that spayed dogs have elevated levels of LH-receptor and GnRH-receptor mRNA in the bladder tissue, and lower contractile strength of muscles. They noted that urinary incontinence occurs at elevated levels in spayed dogs and in post-menopausal women. Thus, it is reasonable to suppose that some ovariectomized mares could also suffer from elevated levels of urinary incontinence.

Sterilization had no effect on movements and space use of feral cats or brushtail possums (Ramsey 2007, Guttilla & Stapp 2010), or greyhound racing performance (Payne 2013). Rice field rats (Rattus argentiventer) tend to have a smaller home range in the breeding season, as they remain close to their litters to protect and nurse them. When surgically sterilized, rice field rats had larger home ranges and moved further from their burrows than hormonally sterilized or fertile rats (Jacob et al. 2004). Spayed possums and foxes (Vulpes vulpes) had a similar core range area after spay surgery compared to before and were no more likely to shift their range than intact females (Saunders et al. 2002, Ramsey 2007).

The likely effects of spaying on mares' home range and habitat use can also be surmised from available literature. Bands of horses tend to have distinct home ranges, varying in size depending on the habitat and varying by season, but always including a water source, forage, and places where horses can shelter from inclement weather or insects (King and Gurnell 2005). It is unlikely that spayed mares will change their spatial ecology but being emancipated from constraints of lactation may mean they can spend more time away from water sources and increase their home range size. Lactating mares need to drink every day, but during the winter when snow can fulfill water needs or when not lactating, horses can traverse a wider area (Feist & McCullough 1976, Salter 1979). During multiple aerial surveys in years following the mare ovariectomy study at the Sheldon NWR, it was documented that all treated individuals appeared to maintain group associations, no groups consisted only of treated females, and none of the solitary animals observed were treated females (Collins and Kasbohm 2016). Because treated females maintained group associations, this indicates that their movement patterns and distances may be unchanged.

Spaying wild horses does not change their status as wild horses under the WFRHBA (as amended). In terms of whether spayed mares would continue to exhibit the free-roaming behavior that defines wild horses, BLM does expect that spayed mares would continue to roam unhindered. Wild horse movements may be motivated by a number of biological impulses, including the search for forage, water, and social companionship that is not of a sexual nature. As such, a spayed animal would still be expected to have a number of internal reasons for moving across a landscape and, therefore, exhibiting 'free-roaming' behavior. Despite marginal uncertainty about subtle aspects of potential changes in habitat preference, there is no expectation that spaying wild horses will cause them to lose their free-roaming nature.

In this sense, a spayed wild mare would be just as much 'wild' as defined by the WFRHBA as any fertile wild mare, even if her patterns of movement differ slightly. Congress specified that sterilization is an acceptable management action (16 USC §1333.b.1). Sterilization is not one of the clearly defined events that cause an animal to lose its status as a wild free-roaming horse (16 USC §1333.2.C.d). Any opinions based on a semantic and subjective definition of what constitutes a 'wild' horse are not legally binding for BLM, which must adhere to the legal definition of what constitutes a wild free-roaming horse, based on the WFRHBA (as amended). BLM is not obliged to base management decisions on personal opinions, which do not meet the BLM's principle and practice to "Use the best available scientific knowledge relevant to the problem or decision being addressed, relying on peer reviewed literature when it exists" (Kitchell et al. 2015).

Spaying is not expected to reduce mare survival rates on public rangelands. Individuals receiving fertility control often have reduced mortality and increased longevity due to being released from the costs of reproduction (Kirkpatrick and Turner 2008). Similar to contraception studies, in other wildlife species a common trend has been higher survival of sterilized females (Twigg et al. 2000, Saunders et al. 2002, Ramsey 2005, Jacob et al. 2008, Seidler and Gese 2012).

Observations from the Sheldon NWR provide some insight into long-term effects of ovariectomy on feral horse survival rates. The Sheldon NWR ovariectomized mares were returned to the range along with untreated mares. Between 2007 and 2014, mares were captured, a portion treated, and then recaptured. There was a minimum of 1 year between treatment and recapture; some mares were recaptured a year later, and some were recaptured several years later. The long-term survival rate of treated wild mares appears to be the same as that of untreated mares (Collins and Kasbohm 2016). Recapture rates for released mares were similar for treated mares and untreated mares.

## Effects of Spaying on Bone Histology

The BLM knows of no scientific, peer-reviewed literature that documents bone density loss in mares following ovariectomy. A concern has been raised in an opinion article (Nock 2013) that ovary removal in mares could lead to bone density loss. That paper was not peer reviewed nor was it based on research in wild or domestic horses, so it does not meet the BLM's standard for "best available science" on which to base decisions (Kitchell et al. 2015). Hypotheses that are forwarded in Nock (2013) appear to be based on analogies from modern humans leading sedentary lives. Post-menopausal women have a greater chance of osteoporosis (Scholz-Ahrens et al. 1996), but BLM is not aware of any research examining bone loss in horses following ovariectomy. Bone loss in humans has been linked to reduced circulating estrogen. There have been conflicting results when researchers have attempted to test for an effect of reduced estrogen on animal bone loss ratesin animal models; all experiments have been on laboratory animals, rather than free-ranging wild animals. While some studies found changes in bone cell activity after ovariectomy leading to decreased bone strength (Jerome et al. 1997, Baldock et al. 1998, Huang et al. 2002, Sigrist et al. 2007), others found that changes were moderate and transient or minimal (Scholz-Ahrens et al. 1996, Lundon et al. 1994, Zhang et al. 2007), and even returned to normal after 4 months (Sigrist et al. 2007).

Consistent and strenuous use of bones, for instance using jaw bones by eating hard feed, or using leg bones by travelling large distances, may limit the negative effects of estrogen deficiency on micro-architecture (Mavropoulos et al. 2014). The effect of exercise on bone strength in animals has been known for many years and has been shown experimentally (Rubin et al. 2001). Dr. Simon Turner, Professor Emeritus of the Small Ruminant Comparative Orthopaedic Laboratory at Colorado State University, conducted extensive bone density studies on ovariectomized sheep, as a model for human osteoporosis. During these studies, he did observe bone density loss on ovariectomized sheep, but those sheep were confined in captive conditions, fed twice a day, had shelter from inclement weather, and had very little distance to travel to get food and water (Simon Turner, Colorado State University Emeritus, written comm., 2015). Dr. Turner indicated that an estrogen deficiency (no ovaries) could potentially affect a horse's bone metabolism, just as it does in sheep and human females when they lead a sedentary lifestyle, but indicated that the constant weight bearing exercise, coupled with high exposure to sunlight ensuring high vitamin D levels, are expected to prevent bone density loss (Simon Turner, Colorado State University Emeritus, written comm., 2015).

Home range size of horses in the wild has been described as 4.2 to 30.2 square miles (Green and Green 1977) and 28.1 to 117 square miles (Miller 1983). A study of distances travelled by feral horses in "outback" Australia shows horses travelling between 5 and 17.5 miles per 24-hour period (Hampson et al. 2010a), travelling about 11 miles a day even in a very large paddock (Hampson et al. 2010b). Thus, extensive movement patterns of wild horses are expected to help prevent bone loss. The expected daily movement distance would be far greater in the context of larger pastures typical of BLM long-term holding facilities in off-range pastures. A horse would have to stay on stall rest for years after removal of the ovaries in order to develop osteoporosis (Simon Turner, Colorado State University Emeritus, written comm., 2015) and that condition does not apply to any wild horses turned back to the range or any wild horses that go into off-range pastures.

### G.4.3. Genetic Effects of Spaying and Neutering

It is true that spayed females and neutered males are unable to contribute to the genetic diversity of the herd. BLM is not obligated to ensure that any given individual in a herd has the chance to sire a foal and pass on genetic material. Management practices in the BLM Wild Horse and Burro Handbook (2010) include measures to increase population genetic diversity in reproducing herds where monitoring reveals a cause for concern about low levels of observed heterozygosity. These measures include increasing the sex ratio to a greater percentage of fertile males than fertile females (and thereby increasing the number of males siring foals) and bringing new animals into a herd from elsewhere.

In herds that are managed to be non-reproducing, it is not a concern to maintain genetic diversity because the management goal would be that animals in such a herd would not breed.

In reproducing herds where large numbers of wild horses have recent and / or an ongoing influx of breeding animals from other areas with wild or feral horses, spaying and neutering 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. It is worth noting that, although maintenance of genetic diversity at the scale of the overall population of wild horses is an intuitive management goal, there are no existing laws or policies that require BLM to maintain genetic diversity at the scale of the individual herd management area or complex. Also, there is no Bureau-wide policy that requires BLM to allow each female in a herd to reproduce before she is treated with contraceptives. Introducing 1-2 mares every generation (about every 10 years) is a standard management technique that can alleviated potential inbreeding concerns (BLM 2010). The NAS report (2013) recommended that managed herds of wild horses would be better viewed as components of interacting metapopulations, with the potential for interchange of individuals and genes taking place as a result of both natural and human-facilitated movements.

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

Roelle and Oyler-McCance (2015) used the VORTEX population model to simulate how different rates of mare sterility would influence population persistence and genetic diversity, in populations with high or low starting levels of genetic diversity, various starting population sizes, and various annual population growth rates. Although those results are specific to mares, some inferences about potential effects of stallion sterilization may also be made from their results. Roelle and Oyler-McCance (2015) showed that the risk of the loss of genetic heterozygosity is extremely low except in cases where all of the following conditions are met: starting levels of genetic diversity are low, initial population size is 100 or less, the intrinsic population growth rate is low (5% per year), and very large fractions of the population are permanently sterilized. Given that 94 of 102 wild horse herds sampled for genetic diversity did not meet a threshold for concern (NAS 2013), the starting level of genetic diversity in most wild-horse herds is relatively high.

In a breeding herd where more than 85% of males in a population are sterile, there could be genetic consequences of reduced heterozygosity and increased inbreeding coefficients, as it would potentially allow a very small group of males to dominate the breeding (e.g., Saltz et al. 2000). Such genetic consequences could be mitigated by natural movements or human-facilitated translocations (BLM 2010). Garrott and Siniff’s (1992) model predicts that gelding 50-80% of mature males in the population would result in reduced, but not halted, mare fertility rates. However, neutering males tends to have short-lived effects, because within a few years after any male sterilization treatment, a number of fertile male colts would become sexually mature stallions who could contribute genetically to the herd.

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## G.5. Intrauterine Devices (IUDs)

Based on promising results from studies in domestic mares, BLM has begun to use IUDs to control fertility as a wild horse and burro fertility control method on the range. The initial management use was in mares from the Swasey HMA, in Utah. The BLM has supported and continues to support research into the development and testing of effective and safe IUDs for use in wild horse mares (Baldrighi et al. 2017, Holyoak et al. unpublished data). However, existing literature on the use of IUDs in horses allows for inferences about expected effects of any management alternatives that might include use of IUDs and support the apparent safety and efficacy of some types of IUDs for use in horses. Overall, as with other methods of population growth suppression, use of IUDs and other fertility control measures are expected to help reduce population growth rates, extend the time interval between gathers, and reduce the total number of excess animals that will need to be removed from the range.

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

IUDs are considered a temporary fertility control method that does not generally cause future sterility (Daels and Hughes 1995). Use of IUDs is an effective fertility control method in women, and IUDs have historically been used in livestock management, including in domestic horses. Insertion of an IUD can be a very rapid procedure, but it does require the mare to be temporarily restrained, such as in a squeeze chute. IUDs in mares may cause physiological effects including discomfort, infection, perforation of the uterus if the IUD is hard and angular, endometritis, uterine edema (Killian et al. 2008), and pyometra (Klabnik-Bradford et al. 2013). In women, deaths attributable to IUD use may be as low as 1.06 per million (Daels and Hughes 1995). The effects of IUD use on genetic diversity in a given herd should be comparable to those of other temporary fertility control methods; use should reduce the fraction of mares breeding at any one time but does not necessarily preclude treated mares from breeding in the future, if they survive and regain fertility.

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

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

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

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

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

More recently, several types of IUDs have been tested for use in breeding mares. When researchers attempted to replicate the O-ring study (Daels and Hughes 1995) in an USGS / Oklahoma State University (OSU) study with breeding domestic mares, using various configurations of silicone O-ring IUDs, the IUDs fell out at unacceptably high rates over time scales of less than 2 months (Baldrighi et al. 2017). Subsequently, the USGS / OSU researchers tested a Y-shaped IUD to determine retention rates and assess effects on uterine health; retention rates were greater than 75% for an 18-month period, and mares returned to good uterine health and reproductive capacity after removal of the IUDs (Holyoak et al., unpublished results). These Y-shaped silicone IUDs are considered a pesticide device by the EPA, in that they work by physical means (EPA 2020). The University of Massachusetts has developed a magnetic IUD that has been effective at preventing estrus in non-breeding domestic mares (Gradil et al. 2019, Joonè et al. 2021). After insertion in the uterus, the three subunits of the device are held together by magnetic forces as a flexible triangle. A metal detector can be used to determine whether the device is still present in the mare. In an early trial, two sizes of those magnetic IUDs fell out of breeding domestic mares at high rates (Holyoak et al., unpublished results). In 2019, the magnetic IUD was used in two trials where mares were exposed to stallions, and in one where mares were artificially inseminated; in all cases, the IUDs were reported to stay in the mares without any pregnancy (Gradil 2019, Joonè et al. 2021).

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# APPENDIX H. STANDARD OPERATING PROCEDURES FOR USE OF FERTILITY CONTROL VACCINES AND INSERTION OF Y-SHAPED SILICONE IUD (10/27/20)

## Standard Operating Procedures (SOPs) for Fertility Control Vaccines

### ***SOPs Common to All Vaccine Types***

*Animal 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 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*
Estimation of population size and growth rates (in most cases, using aerial surveys) should be conducted periodically after treatments.

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.

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 (Reno, Nevada). A copy of the form and data sheets and any photos taken should be maintained at the field office.

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 darts, 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.

## Insertion of Y-shaped Silicone Intrauterine Device (IUD)

***Background***

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

***Preparation***

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

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

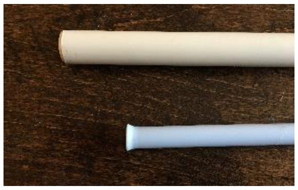

Figure 1. Interior and exterior pipes (unassembled), showing the ends that go into the mare

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

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

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

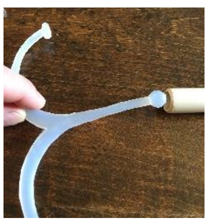

Figure 3. Insert the stem end of the IUD into the exterior pipe.

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

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

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

Some practitioners may choose to provide sedation. If so, when the mare’s head starts to droop, it may be advisable to tie the tail up to prevent risk of the animal sitting down on the veterinarian’s arm (i.e., double half hitch, then tie tail to the bar above the animal).
Some practitioners may choose to provide a dose of long-acting progesterone to aid in IUD retention. Example dosage: 5mL of BioRelease LA Progesterone 300 mg/mL (BET labs,

Lexington KY), *or* long-acting Altrenogest). No other intrauterine treatments of any kind should be administered at the time of IUD insertion.

***Insertion Procedure:***

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

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

***Label for Y-Shaped Silicone IUD for Feral Horses***

**Y-Shaped Silicone IUD for Feral Horses**

The *Y-Shaped Silicone IUD for Feral Horses* is an intrauterine device (IUD) comprised solely of medical-grade, inert, silicone that is suitable for use in female feral horses (free-roaming or "wild" *Equus caballus*). Intended users include government agencies with feral horses in their management purview, Native American tribes that have management authority over feral horses, and authorized feral horse care or rescue sanctuaries that manage feral horses in a free ranging environment.

The *Y-Shaped Silicone IUD for Feral Horses* can mitigate or reduce feral horse population growth rates because these IUDs can provide potentially reversible fertility control for female feral horses. This IUD prevents pregnancy by its physical presence in the mare's uterus as long as the IUD stays in place. In trials, approximately 75% of mares living and breeding with fertile stallions retained the *Y-Shaped Silicone IUD for Feral Horses* over two breeding seasons. None of the mares that kept their IUDs became pregnant during an experimental trial. After IUD removal, the majority of mares returned to fertility.

Directions for Use:

The *Y-Shaped Silicone IUD for Feral Horses* is to be placed in the uterus of feral horse mares by a veterinarian. The *Y-Shaped Silicone IUD for Feral Horses* is intended for use in feral mares that are at least approximately 1 year old, where age is determined based on available evidence, such as tooth eruption pattern.

IUDs must be sterilized before use. The IUD is inserted into the uterus using a thin, tubular applicator, similar to a shielded culture tube commonly used in equine reproductive veterinary medicine, in a manner similar to methods used for uterine culture of domestic mares. Feral mares with IUDs should be individually marked and identified (i.e., with an RFID microchip, or via visible freeze-brand on the hip or neck).

Caution:

These IUDs are only to be used in mares that are confirmed to be not pregnant. Checking pregnancy status can be accomplished by methods such as a transrectal palpation and/or ultrasound performed by a veterinarian. If a *Y-Shaped Silicone IUD for Feral Horses* is inserted in the uterus of a pregnant mare, it may cause the pregnancy to terminate, and the IUD to be expelled.

Manufactured for:
U.S. Bureau of Land Management (97949)
1340 Financial Blvd., Reno, NV 89052
EPA Est.: 97628-MI-1

# APPENDIX I. RESPONSE TO COMMENTS

As of December 23, 2020, the WRFO had received comments from 15 individuals or organizations. Substantive comments are those that question the accuracy of the information in the EA, the assumptions used for the analysis, present new information relevant to the analysis, or present reasonable alternatives other than those analyzed in the EA (BLM NEPA Handbook, Section 6.9.2.1). Preliminary EA comments received by the public are summarized below, with BLM responses.

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| **Comment #/Comment Received From:** #1/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** Friends of Animals asks BLM to consider giving horses room to roam freely in the limited space allocated to them. In particular, BLM should circulate an Environmental Impact Statement (EIS) or new Environmental Assessment (EA) that analyzes additional alternatives in detail, including adjusting the Appropriate Management Level (AML) in the PEDHMA, expanding the area available to wild horses, reducing the amount of forage allocated to private ranchers for grazing their domestic cattle and sheep, reducing the amount of oil & gas related activities, and protecting predators to create a thriving, natural ecological balance without the need to artificially reduce wild horses populations. |
| **BLM Response:** Refer to Section 1.1.2 of the EA for a description of AML, also refer to the updated Appendix E. E3. Alternatives Related to Population Size or Structure at Adjust the Appropriate Management Level and to Section 1.4 for background on land use planning decisions that led to the determination of AML. Refer to Appendix E. E3. Alternatives Related to Population Size or Structure, Wild Horse Numbers Controlled by Natural Means Changes regarding predators. Also refer to the Affected Environment of Wild Horses, Section 3.4.5 in the DOI-BLM-CO-110-2010-0089-EA. These management decisions are outside the scope of this analysis. |

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| **Comment #/Comment Received From:** #2/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** BLM has not considered whether removal is necessary based on current information. |
| **BLM Response:** Section 1.1.1, and Appendix B of the EA contain a review of the current situation, in which an excess of wild horses exists both inside and outside of PEDHMA boundaries. |

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| **Comment #/Comment Received From:** #3/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** In the PEA, BLM fails to consider what qualifies as a self-sustaining, healthy population of wild horses and how its proposed action would impact the health and sustainability of wild horses. |

**BLM Response:** The effects of maintaining the herd within established AML, including the use of fertility control measures, was analyzed in the EA. The herd would continue to be at a size of 135 (low AML) or more. The BLM would continue to monitor genetic diversity of wild horses remaining in the HMA through DNA sampling in keeping with WO-IM 2009-062. If genetic diversity, as measured by observed heterozygosity, is found to be excessively low, then periodic introductions of additional wild horses would augment genetic diversity, as addressed in Section 3.1 Selective Removal and Augmentation in the EA. Additional text has been added to EA Section 5.3.1 to clarify the PEDHMA herd's close genetic relatedness to a large number of other herds.

Because of history, context, and periodic introductions, wild horses that live in the PEDHMA 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. In the specific case of the PEDHMA, the ancestry of horses in this area is of mixed origin from a number of domestic breeds commonly used in the region (Cothran 2010). These animals are part of a larger metapopulation (NAS 2013) that has demographic and genetic connections with other BLM-managed herds in Colorado, and beyond.

Specifically, Appendix F of the 2013 NAS report contains 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, R., J. D. Ballou, and D. A. Briscoe. 2010. Introduction to conservation genetics, second edition. Cambridge University Press, New York, New York.). Fst values for the PEDHMA herd had pairwise Fst values that were less than 0.075 with 77 other sampled herds. These results support the interpretation that PEDHMA horses are components in a highly connected metapopulation that includes horse herds in many other HMAs.

**Comment #/Comment Received From:** #4/Jennifer Best, Friends of Animals (FOA)

**Summarized Comment:** BLM also fails to adequately analyze any plans or alternatives that protect the wild horses in the PEDHMA.

**BLM Response:** The proposed action analyzes managing the wild horse population within PEDHMA to within the established AML. Refer to Section 1.1.2 of the EA for a description of AML. Refer to Section 3.1 for analysis of the continued long-term management and protection of wild horses within the PEDHMA in accordance with the WFRHBA. Appendix E includes a number of alternatives considered but not analyzed in detail.

| Comment #/Comment Received From: #5/Jennifer Best, Friends of Animals (FOA) |
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| BLM has not made a proper determination that there are excess horses or that action is necessary to remove them as required by the WHBA at its own guidance documents. |
| **BLM Response:** Refer to Appendices B, Review of Current Situation Memo to the Field Manager to inform the Field Manager of the current wild horse populations and land health status. Refer to Appendices C, Excess Determination Memo from the Field Manager to Acting Northwest District Manager which determines that the number of wild horses are in excess and there is over utilization of primary resources (forage and water) on public state and private lands within the PEDHMA. As a result, this is negatively impacting our ability to preserve and maintain a thriving natural ecological balance (TNEB) and multiple-use relationship in that area. |

| Comment #/Comment Received From: #6/Jennifer Best, Friends of Animals (FOA) |
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| **Summarized Comment:** However, the PEA indicates that it will no longer allow wild horses in the Greasewood Allotment. |
| **BLM Response:** Wild horses would continue to live and be managed within the Greasewood Allotment area of the PEDHMA. The BLM has received requests from private land owners to remove excess horses that are impacting the private lands. Section 1.1.1 has been updated to clarify that wild horses would continue to be managed on public land within the Greasewood addition to the PEDHMA. The BLM prepared a Categorical Exclusion for removal of wild horses from private lands, refer to Section 1.5.2. |

| Comment #/Comment Received From: #7/Jennifer Best, Friends of Animals (FOA) |
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| **Summarized Comment:** The 1997 RMP requires continual monitoring and reevaluation of the AML. BLM failed to conduct monitoring as required by the 1997 RMP and other land use plans. As such, BLM cannot proceed with the proposed action. The required monitoring and evaluations should take place, and be made publicly available, before BLM conducts any action to remove wild horses. |
| **BLM Response:** The 1997 RMP requires BLM to conduct monitoring studies and then decide if AML should be adjusted (at page 2-26). "Monitoring studies will be conducted and the long term appropriate management level (AML) for the Herd Management Area will be adjusted based on the results of this monitoring." |

| Comment #/Comment Received From: #8/Jennifer Best, Friends of Animals (FOA) |
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| **Summarized Comment:** BLM's proposed action and alternatives—to continue removals and fertility control ten years into the future—conflict with the WHBA, applicable land use plans, |

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| and BLM's own regulations and guidance. The WHBA requires BLM to make a determination that wild horses are excess, and that immediate removal is necessary before removing them. This decision must be based on currently available information. Current inventories and site-specific removal decisions are also necessary to ensure that BLM manages wild horses at the "minimal feasible level." |
| **BLM Response:** As stated in the proposed action, Section 3.1, "Population inventories and routine resource/habitat monitoring would continue to be conducted between gather cycles to document current population levels, growth rates, and areas of continued resource concern (wild horse concentrations, riparian impacts, over-utilization, etc.) prior to any follow-up gather." Under the proposed action, to meet the purpose and need of maintaining the wild horse and burro population within AML, it is likely multiple gathers would need to occur. The proposal for a 10-year gather plan is consistent with other BLM gather decisions and does not reflect a "New Rule" or new approach. BLM's authority to use 10-year planning for gather operations was recently reviewed in federal court, in *Friends of Animals v. Silvey*, in which the Ninth Circuit Court of Appeals held that "BLM's use of a single gather plan and a single environmental assessment to cover a period of years and a series of individual gather operations is not a departure from the agency's past practice." 820 Fed.Appx. 513, 516–517 (9th Cir. 2020). The *Silvey* decision also rejected the argument that the "current information" requirement found in the WHBA precludes BLM from enacting a long-term gather plan. *Id.* at 517. Like the proposed action, the Ninth Circuit Court of Appeals has previously upheld 10-year phased gather plans to the low range of AML. *American Wild Horse Campaign v. Bernhardt*, 963 F.3d 1001 (9th Cir. 2020). At the "gather plan" stage of the gather process, BLM can rely on a single EA and the current determination of excess. |

| **Comment #/Comment Received From:** #9/Jennifer Best, Friends of Animals (FOA) |
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| BLM does not have, and cannot have, information that removal is necessary throughout the next decade. Range conditions, wild horse numbers, and the AML can change each year. As such, the WHBA, BLM's implementing regulations, and its own guidelines require site specific analysis and continued monitoring prior to removing excess wild horses. 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 PEA at issue here. Here, 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. This is a clear violation of the law. |
| **BLM Response:** Refer to comment response #8, including reference to the recent appeals court case ruling in BLM's favor about this topic.<br><br>In March 2019, the BLM issued Permanent Instruction Memorandum (PIM)-2019-004, that established policy for issuance of wild horse gather decisions. Specifically, PIM-2019-004 directs the BLM to "issue decisions authorizing gathers, removals, or population control actions through a phased approach or over a multi-year period when it determines that such an approach would help it achieve its management objectives." |

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| Regarding AML, refer to the updated Section E. 3. in the EA and for the reasons at Appendix E. 3. Alternatives Related to Population Size or Structure. |

| **Comment #/Comment Received From:** #10/Jennifer Best, Friends of Animals (FOA) |
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| **Summarized Comment:** BLM's plan to continually remove horses to "maintain" the outdated AML for the next ten years clearly violates the WHBA because BLM needs to make specific determinations about the need to remove wild horses and implement that decision immediately. Thus, it does not have authority to go back and "maintain" populations after initial removals have been completed. |
| **BLM Response:** Refer to comment response #8, including reference to the recent appeals court case ruling in BLM's favor about this topic |

| **Comment #/Comment Received From:** #11/Jennifer Best, Friends of Animals (FOA) |
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| **Summarized Comment:** BLM has not conducted the necessary monitoring and evaluations or made a proper excess determination for the initial roundup and removal of wild horses, let alone the continued removal and harassment of wild horses for the next ten years. |
| **BLM Response:** Refer to Appendices B and C for review of current situation and determination of excess. |

| **Comment #/Comment Received From:** #12/Jennifer Best, Friends of Animals (FOA) |
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| **Summarized Comment:** BLM's reliance on guidance in IM 2020-012 (Wild Horses and Burro Gather Planning, Scheduling, and Approval) to issue a long term gather plan is improper. This memorandum was issued without following necessary procedures, it conflicts with the WHBA, and it was issued under the direction and approval of William Perry Pendley during his unlawful tenure as acting Director of the BLM. |
| **BLM Response:** BLM's ability to issue a 10-year gather plan is supported by several decisions by the Ninth Circuit Court of Appeals as well as internal instruction memorandums. In March 2019, the BLM issued Permanent Instruction Memorandum (PIM)-2019-004, that established policy for issuance of wild horse gather decisions. Specifically, PIM-2019-004 directs the BLM to "issue decisions authorizing gathers, removals, or population control actions through a phased approach or over a multi-year period when it determines that such an approach would help it achieve its management objectives." |

IM 2020-012 among other guidance, directs the Authorized Officer should evaluate multiple management options to achieve and maintain the AML. Each management option should generally be evaluated for implementation by the BLM over a multiyear period.

Please refer to the response to Comment # 8, including reference to the recent appeals court cases upholding BLM's long-term gather plans.

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| **Comment #/Comment Received From:** #13/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** The proposed action and alternatives in the PEA would result in major environmental impacts and warrant preparation of an EIS. |
| **BLM Response:** Based upon a review of the EA and the supporting documents, BLM determined that the Proposed Action would not have a significant effect on the quality of the human environment, individually or cumulatively with other actions in the general area. Refer to the rationale provided in the Finding of No Significant Impact (FONSI) regarding context and intensity. Impacts were analyzed in the EA and Appendices and are well understood —the action alternatives are not expected to be significant, involve unique or unknown risks, and are not highly controversial. When there is a determination that the actions presented in an EA are not significant, that is presented in a FONSI. BLM has not identified any significant impacts that would trigger the need for an EIS. Refer to "significance" and "context and intensity" as described in BLM NEPA Handbook 1790-1. |

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| **Comment #/Comment Received From:** #14/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** The intensity of the proposed action also indicates that the action necessitates further review in an EIS. This action has severe impacts and covers over one million acres of land with unique characteristics. |
| **BLM Response:** The EA analyzes impacts of gather, removal, and fertility control on wild horses located within the PEDHMA which consists of approximately 190,130 acres. Refer to the response for comment #13. |

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| **Comment #/Comment Received From:** #15/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** The effects of the proposed action and alternatives are highly controversial and involve unique and unknown risks. For example, the impacts of fertility control measures are highly controversial and involve unique and unknown risks. This action could also have a precedential effect on other future wild horse roundups. |
| **BLM Response:** Refer to Appendix G for updated review of Fertility Control Treatments including methods, risks and impacts. Impacts were analyzed in the EA and Appendices and |

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| are well understood —the action alternatives are not expected to be significant, involve unique or unknown risks, and are not highly controversial in the context of NEPA analyses. |

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| **Comment #/Comment Received From:** #16/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** Additional NEPA analysis is needed on the following: (1) the impact of the proposed action and alternatives on the genetic viability of the wild horse population in the PEDHMA; (2) the impacts of fertility control measures; (3) the positive impacts of wild horses on the environment and actual cause of damage to the range; and (4) the behavioral and physiological impacts of BLM's proposed action and alternatives on wild horses. |
| **BLM Response:** Refer to Section 5.3.1 for review of genetic diversity and viability as well as the impacts of fertility control measures. Additional text has been added there, with further details about available information on existing genetic diversity and relatedness to other managed wild horse herds.<br><br>Refer to the update Appendix E. Alternatives Considered but Not Analyzed in Detail, E.3. Alternatives Related to Population Size or Structure at Adjust the Appropriate Management Level.<br><br>Refer to Section 5.3.2 for an analysis of the potential behavioral and physiological impacts to wild horses from each alternative.<br><br>Also refer to Appendix G for a scientific literature review of wild horse effects on rangeland ecosystems, considered by BLM on the points raised by commentor. For example, that review acknowledges that wild horses can be effective spreaders of seeds. |

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| **Comment #/Comment Received From:** #17/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** BLM must consider the impacts of its proposed actions on the genetic viability of the wild horses in and around the PEDHMA. BLM proposes to remove the majority of wild horses in the PEDHMA, but it fails to take into account 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, it also failed to disclose any enforceable plan to protect the health, viability, and sustainability of these wild horses. Instead, BLM merely punted the decisions about the health of the heard to some later date, likely without no public input. This is concerning, especially given the small population size of the PEDHMA wild horses. A BLM-sponsored report by the National Research Council suggests that a population closer to 5,000 may be necessary to avoid inbreeding, depression, and other diseases. Reducing the population to 135 wild horses, as proposed, is not sufficient to maintain a healthy and sustainable population. The use of fertility control only compounds the problem. Again, BLM did not take hard look at the impact of these measures. |

**BLM Response:** Refer to Section 5.3.1 of the EA as well as Appendix G for a review of genetic diversity and viability. Additional text has been added there, with further details about available information on existing genetic diversity and relatedness to other managed wild horse herds. The commenters implication that the PEDHMA herd should approach a size of 5,000 animals to be sustainable is misguided. The NAS (2013) commentary about population sizes and maintenance of genetic diversity is in the context of that report's suggestion that BLM focus on management of genetic diversity at the level of wild horse metapopulation(s). The PEDHMA herd is not an isolated population in the same sense that a rare endemic species might be – rather, it is one subpopulation in a larger metapopulation of connected herds, with a history of diverse domestic breeds as founders, and evidence of recent genetic interchange.

Refer to Section 5.3 for a review of impacts from the proposed action to the health of wild horses, also refer to Appendix D, Animal Welfare Standards.

The NAS report further states "it does not appear to be realistic to attempt to manage each HMA of HMA complex with a goal of a minimum of 5,000 animals." Therefore, management of the HMAs as a metapopulation, in the form of natural and assisted movement of animals between HMAs, would be necessary for the long-term persistence of the horses at the HMA or HMA-complex level. Selective removal and herd augmentation is described in the proposed action, Section 3.1.

**Comment #/Comment Received From:** #18/Jennifer Best, Friends of Animals (FOA)

**Summarized Comment:** BLM has not conducted additional monitoring or testing in accordance with the recommendations of the report or its handbook. Moreover, in a 2011 Environmental Assessment, BLM stated that it would collect genetic samples from wild horses to continue to monitor the genetic diversity/health of the Piceance-East Douglas herd. However, it gathered 276 wild horses in 2011 and either failed to collect genetic samples altogether or failed to disclose and consider the results in the PEA.

**BLM Response:** The 2011 EA stated "If the BLM gathers a statistically viable sample of wild horses (i.e., 25 returned wild horses), then the BLM would collect genetic samples. This information will be used to continue to monitor the genetic diversity/health of the Piceance-East Douglas herd." BLM did not gather enough animals to collect a statistically viable sample of animals returned to the range, of the 276 animals gathered, 15 were returned to the range in 2011. However, in contrast to the 2011 decision, under the action now being considered, genetic samples will be collected and sent for analysis from the first gather of 25 adult animals or more, stemming from any decision that follows this EA, whether those animals will be or will not be returned to the range (see text added to Section 5.3.1).

**Comment #/Comment Received From:** #19/Jennifer Best, Friends of Animals (FOA)

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| **Summarized Comment:** BLM fails to provide specific benchmarks for when it would intervene or alter its management plan to preserve genetic diversity. As explained in BLM's NEPA handbook, if BLM is going to rely on mitigation measures such as introducing wild horses, then it must include sufficient detail about how this will be implemented to constitute an enforceable commitment. Here, BLM failed to do so. |
| **BLM Response:** Management of wild horses and burros should be accomplished at the minimum feasible level to maintain a thriving natural ecological balance. The continued presence of excess wild horses is not consistent with maintaining a thriving natural ecological balance. Removing 703 wild horses would support maintaining a thriving natural ecological balance with multiple uses in this area.<br><br>The EA documents that excess wild horses exist within the PEDHMA. Part of the documentation for that determination falls under sections 3 and 4 of the WFRHBA (Appendix B & C). Section 1.5.1 discusses statutes and regulations that supports gathering excess wild horses from the PEDHMA, including the WFRHBA.<br><br>The BLM Wild Horse and Burro Herd Management Handbook (BLM 4700-1, 2010) identifies thresholds of observed heterozygosity, below which there should be high levels of concern about a given herd's genetic diversity. Independent of those thresholds, BLM tends to follow the advice of the population genetics laboratory that analyzes genetic monitoring samples; if a report is returned to BLM indicating that a herd could benefit from introduction of fertile animals from an outside herd, BLM generally does so. |

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| **Comment #/Comment Received From:** #20/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** BLM must look at baseline data of the wild horses' current health, viability, and genetic diversity. This is necessary to analyze how proposed actions will impact the wild horses in the PEDHMA. |
| **BLM Response:** Please refer to EA Section 5.3.1, which includes additional text about genetic diversity, and connectivity with other wild horse herds. Section 5.3.3 and Appendix G allude to potential health effects of management actions. |

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| **Comment #/Comment Received From:** #21/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** The PEA also completely fails to consider how the proposed action and alternatives, in combination with past and foreseeable future removals/fertility controls, will have cumulative impacts on the genetic health, diversity, and sustainability of wild horses in and around the PEDHMA. BLM must disclose and analyze this information before taking any action to impact the wild horses in or around the PEDHMA. |
| **BLM Response:** Refer to Section 5.3.1 as well as Appendix G for a review of expected and possible effects of fertility control on genetic and diversity. Renewed, periodic genetic |

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| monitoring will inform BLM’s decisions about whether and when to augment the herd with any fertile animals from other HMAs. |

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| **Comment #/Comment Received From:** #22/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** BLM fails to take a hard look at how wild horses are impacting the range. BLM does not analyze current information on grazing utilization and distribution, trends in ecological conditions, climate data, or any other evidence that deterioration from wild horses is occurring in the PEDHMA. Nor does the PEA provide an explanation of how BLM determined the impact of horses, as compared to other uses, on the condition of the range. |
| **BLM Response:** Refer to Response to Comment #5. |

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| **Comment #/Comment Received From:** #23/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** BLM never determines what degradation is expected from wild horses as compared to other uses. Without this baseline information, the public cannot meaningfully comment on, or compare, proposed alternatives. Moreover, BLM itself cannot make an informed decision without first taking a hard look at how livestock, as well as oil and gas related activities, impact the range as compared to wild horses. |
| **BLM Response:** Refer Comment #9, also refer to Appendix G.2 for a review of Effects of Wild Horses and Burros on Rangeland Ecosystems. This comment is outside of the scope of this analysis. |

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| **Comment #/Comment Received From:** #24/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** 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 WHBA, the applicable land use plans, and its own guidance documents. BLM also fails to meet its obligations under NEPA to take a hard look at the impacts of proposed actions. |
| **BLM Response:** Refer to Section 3.4 in the EA and Appendix E. E3 regarding AML adjustment. Regarding impacts of the proposed action the analysis focuses on the gather, removal and fertility control within the PEDHMA. |

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| **Comment #/Comment Received From:** #25/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** Friends of Animals urges BLM to review and consider recent scientific research and disclose the actual impacts of population control on wild horses. |

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| **BLM Response:** Refer to Appendix G which includes scientific literature reviews addressing five topics: effects of gathers, effects of wild horses and burros on rangeland ecosystems, effects of fertility control vaccines and sex ratio manipulations, effects of sterilization, and effects of intrauterine devices (IUDs). This scientific literature review has been updated to reflect newly available studies from as recently as January 2021 (Joonè et al 2021). |

| Comment #/Comment Received From: #26/Jennifer Best, Friends of Animals (FOA) |
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| **Summarized Comment:** Given the controversial, unknown, and potentially adverse impacts of PZP and GonaCon, BLM must conduct further analysis before proceeding with any action that includes the use of fertility controls. |
| **BLM Response:** Refer to Appendix G, also see response for Comment #25. Use of the fertility control measures noted in Appendix G is not controversial. In this context, the commenter's apparent unease with the use of a given management action does not make that action "controversial." 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. When there is a determination that the actions presented in an EA are not significant, that is presented in a FONSI. BLM has not identified any significant impacts that would trigger the need for an EIS. Refer to "significance" as described in BLM NEPA Handbook 1790-1 and 40 CFR 1508.27(b)(4))- "Degree to which effects are likely to be highly controversial." The effects of managing a portion of the herd with fertility control methods are known. Discussions about herds that are 'non-reproducing' in whole or in part are in the context of a 'metapopulation' structure, where self-sustaining herds are not necessarily at the scale of single HMAs. So long as the definition of what constitutes a self-sustaining population includes the larger set of HMAs that have past or ongoing demographic and genetic connections – as is recommended by the National Academies of Sciences 2013 report – it is clear that single HMAs can be managed to include some animals treated with fertility control methods while still allowing for a self-sustaining population of wild horses or burros at the broader spatial scale. |

| **Comment #/Comment Received From:** #27/Jennifer Best, Friends of Animals (FOA) |
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| **Summarized Comment:** BLM fails to acknowledge or discuss the harmful consequences of the stress, specifically the stress caused by helicopter roundups, to all wild horses on the range. |
| **BLM Response:** BLM is obligated to manage herds in such a way as to achieve a thriving natural ecological balance. Analysis of impacts from stress is included in Section 5.3.2 of the EA, refer also to Appendix G. BLM's capture and handling operations will follow the CAWP (Appendix D), aimed at reducing stress and improving animal welfare. Appendix G also notes that the potential, temporary stress due to gathers and removals may be placed in context by |

weighing that against the chronic stress attributable to resource scarcity under conditions of high population density.

**Comment #/Comment Received From:** #28/Jennifer Best, Friends of Animals (FOA)

**Summarized Comment:** Stress of capture and captivity can put the horse “on a path of accelerated deterioration,” leading to long-term physical and mental health problems and a shortened life expectancy. Likewise, the ongoing trauma experienced by wild horses after the initial roundup extends to both the captured wild horses and those wild horses (if any) that were left on the range. BLM can longer sweep these impacts under the rug.

**BLM Response:** See Response to comment #27.

**Comment #/Comment Received From:** #29/Jennifer Best, Friends of Animals (FOA)

**Summarized Comment:** The PEA indicates that there will be an ever-increasing wild horse population if BLM does not conduct the roundup. However, such concerns are misguided, and BLM provides **no** citations to support its conclusion. Contrary to BLM’s unsupported conclusions, wild horses are self-regulated, and the population would likely come into balance with the ecosystem if left alone.

**BLM Response:** BLM has documented a continued increase in the wild horse population in the PEDHMA from the 2011 gather/removal operation to the inventory performed in 2016 shows an increase during that timeframe. Conditions in the PEDHMA have supported wild horses populations above AML. The NAS report (2013) examined population regulation in detail, and found that wild horses are generally “regulated” only once population densities become so large that resources become limited, i.e., forage degradation to the point that large populations cannot be sustained and die-off occurs. The condition of natural resources and wildlife populations at such a point is extremely degraded.

**Comment #/Comment Received From:** #30/Jennifer Best, Friends of Animals (FOA)

**Summarized Comment:** BLM should not ignore the positive impacts of wild horses. BLM should consider adjusting the AML for the PEDHMA and allowing wild horses in the West Douglas Herd Area and North Piceance Herd Area. Instead of condemning the wild horses to a life of captivity, BLM should manage wild horses as a healthy, self-sustaining population.

**BLM Response:** BLM manages wild horses in order to maintain a healthy wild horse population within the PEDHMA. Regarding AML, refer to the updated Section E. 3. in the EA and for the reasons at Appendix E. 3. Alternatives Related to Population Size or Structure.

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| **Comment #/Comment Received From:** #31/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** BLM should consider reasonable alternatives to achieve a thriving natural ecological balance in the PEDHMA, including adjusting the current AML, expanding the area available to wild horses, adjusting forage allocated to cattle and sheep, reducing other uses such as oil and gas related activities, and allowing natural controls. To the extent that BLM argues that the purpose and need of the action is limited to removing wild horses, it has defined the purpose and need in unreasonably narrow terms. |
| **BLM Response:** The commenter appears to be suggesting that the BLM revise the RMP; this EA is considering action alternatives that would be consistent with the existing RMP. |

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| **Comment #/Comment Received From:** #32/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** BLM fails to consider re-evaluating the AML. Not only is this a reasonable and feasible alternative, but it is also required. Specifically, the 1997 White River Resource Area Resource Management Plan ("1997 RMP") mandates that BLM conduct monitoring studies and adjust the AML based on this monitoring. According to BLM's guidance, it should also perform aerial counts of the herds at least once every three years. BLM has not conducted the necessary monitoring and population inventories. The AML BLM uses in the PEA was established at least 18 years ago. BLM does not disclose information about the basis of the AML and whether it remains valid. |
| **BLM Response:** Regarding the population inventory and ability to collect that data every three years as stated by commentor the ability to gather population inventory data aerial counts is contingent upon funding, personnel, and on ground conditions so much so it is often the case that BLM's aerial inventories are conducted outside of the guidance. For 2021, WRFO has been funded for a wild horse aerial inventory/census and is it the process of being scheduled.<br><br>Funds have been received by WRFO and are allocated for an 3rd party comprehensive utilization monitoring study (2018 through 2021). Expected results will be similar to what was predicted in the 2011 EA (refer to Section 4.6.4 Effects on Livestock and Table 4-3, and Section 4.6.5 Effects on Wild Horses spells out the consequences of an overpopulation of wild horses.<br><br>Available information based on the most recent aerial inventory, though, is more than adequate to conclude that the number of wild horses in PEDHMA far exceeds AML. Refer to Section 1.1.2 of the EA for a description of AML, also refer to the updated Appendix E. E3. Alternatives Related to Population Size or Structure at <u>Adjust the Appropriate Management Level</u> and to Section 1.4 for background on land use planning decisions that led to the determination of AML. |

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| **Comment #/Comment Received From:** #33/Jennifer Best, Friends of Animals (FOA) |

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| **Summarized Comment:** BLM's reliance on the outdated AML to justify rounding up wild horses in 2021 and ten years into the future is inappropriate and BLM has an obligation to reevaluate the AML. |
| **BLM Response:** Refer to Comment #32. While some background information from the 2011 gather EA is still relevant and included by reference, this EA established the contemporary purpose and need for the action and analyzed alternatives accordingly. AML evaluation is outside the scope of this decision.<br><br>Refer to Comment #8 and #12. Removal of excess wild horses would be based upon a review of current conditions. |

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| **Comment #/Comment Received From:** #34/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** BLM has never adequately explained or justified this drastic reduction in wild horse habitat after Congress mandated that wild horses be considered an "integral part" of our public lands. |
| **BLM Response:** Section 1.1.1 of the EA describes the Management History of the PEDHMA. |

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| **Comment #/Comment Received From:** #35/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** Before approving a ten-year plan to manage wild horses in this area BLM must consider making more area available to these wild horses. |
| **BLM Response:** The geographic extent of the PEDHMA was reviewed in land use plan decisions and is outside the scope of this analysis. |

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| **Comment #/Comment Received From:** #36/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** The PEA fails to analyze reducing the number of cattle and sheep allowed to graze in the PEDHMA to improve the condition of the range. Instead, the PEA erroneously concludes that it would be inconsistent with the 1997 RMP. |
| **BLM Response:** Forage allocations are outside the scope of this analysis. Refer to Appendix E, Section E.4. |

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| **Comment #/Comment Received From:** #37/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** Nothing in the 1997 RMP restricts BLM from reducing the amount of forage allocated for cattle and sheep. To the contrary, the 1997 RMP explicitly states that |

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| “[l]ivestock grazing will be suspended or eliminated if livestock use has either achieved wildlife habitat objective or are detracting from habitat objectives developed for three areas.” |
| **BLM Response:** The RMP text is referring specifically to issuance of livestock grazing permits/leases in three State Wildlife Areas within the resource area and the conditions under which grazing authorizations will be issued. Livestock forage reduction was included as an alternative considered but not carried forward, refer to Appendix E, Section E.4. |

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| **Comment #/Comment Received From:** #38/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** The 1997 RMP states that “periodically, and not to exceed five-year intervals, the Area Manager shall update the plan by evaluating: 1) process in implementing plan decision; 2) the effectiveness of plan decisions in achieving desired outcomes; and 3) identifying the need for plan amendments.” |
| **BLM Response:** The BLM Colorado State Office and WRFO completed a plan evaluation in 2020 that accomplished all of those tasks. The signing of that evaluation is expected to take place by the end of March 2021. The availability of this evaluation online has not been determined at this time but most likely can be received if requested in writing once it is available. |

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| **Comment #/Comment Received From:** #39/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** BLM must consider reducing the forage allotted to livestock so that wild horses can thrive and be an integral part of the natural system of public lands, as required by law. |
| **BLM Response:** Forage allocations are outside the scope of this analysis. BLM will continue to strive to manage wild horses in a manner that a thriving natural ecological balance can be achieved. |

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| **Comment #/Comment Received From:** #40/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** The proposed action, to remove wild horses while refusing to reduce forage for private ranchers blatantly violates the WHBA, which states that the range should be principally devoted to wild horses. |
| **BLM Response:** The law's language stating that public ranges where wild horses and burros were found roaming in 1971 may be managed "principally but not necessarily exclusively" for the welfare of these animals refers to the Interior Secretary's power to "designate and maintain specific ranges on public lands as sanctuaries for their protection and preservation" -- which are, thus far, the Pryor Mountain Wild Horse Range (in Montana and Wyoming), the Nevada Wild Horse Range (located within the northcentral portion of Nellis Air Force Range), the |

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| Little Book Cliffs Wild Horse Range (in Colorado), and the Marietta Wild Burro Range (in Nevada). The "principally but not necessarily exclusively" language applies to specific Wild Horse Ranges, not to Herd Management Areas in general. The Code of Federal Regulations (43 CFR, Subpart 4710.3-2) states: "Herd management 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." |

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| **Comment #/Comment Received From:** #41/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** Friends of Animals requests that BLM analyze an alternative to the proposed roundup that allocates more forage to wild horses rather than remove them from the PEDHMA. |
| **BLM Response:** Refer to Comments #36. Forage allocation is outside the scope of this analysis. |

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| **Comment #/Comment Received From:** #42/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** The PEA claims, with no support or citations, that horses are not a self-regulating species and that this “would result in a steady increase in numbers which would continually exceed the carrying capacity of the range until severe and unusual conditions that occur periodically --such as blizzards or extreme drought -- cause catastrophic mortality of wild horses.” |
| **BLM Response:** Refer to comment response #29 and refer to the NAS report (2013) that addresses population regulation. BLM is unaware of many species in existence that are self-regulating. Ecological studies have consistently shown that natural populations are generally considered to be limited by external factors such as resource availability, predation, etc. |

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| **Comment #/Comment Received From:** #43/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** The EA’s failure to consider that vegetation “may stabilize” and its unsupported conclusions regarding “catastrophic mortality” are not the hard look required by NEPA. Moreover, studies have found that mountain lions can limit wild horse populations in the United States. |
| **BLM Response:** As discussed in the 2011 EA, DOI-BLM-CO-110-0058-EA Section 3.4.2, vegetation communities may stabilize, however those communities will likely be undesirable (cheatgrass monoculture) which provide little habitat and forage value. An irreversible transition to vegetation communities with limited forage utility would result in mortality when the limits of forage availability is exceeded. |

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| The 2013 NAS review (page 6) found predation will not typically control population growth rates of free ranging wild horses with mountain lions. |

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| **Comment #/Comment Received From:** #44/Jennifer Best, Friends of Animals (FOA) |
| **Summarized Comment:** BLM should consider a natural control alternative, that includes protection of native predators such as mountain lions. BLM's failure to consider this alternative in detail ignores its obligation to manage wild horses at the minimal feasible level, and its obligation under NEPA to consider reasonable alternative. |
| **BLM Response:** Colorado Parks and Wildlife is responsible for the number of big game licenses that are issued. The NAS review found predation would not, typically, control population growth rates of free ranging wild horses. Population control by Natural Means was an alternative considered but not carried forward, Refer to Appendix E, Section E.3. Agaikn, refer to Section 3.4.5 Affected Resources - Wild Horses in the incorporated document DOI-BLM-CO-110-2010-0089-EA. |

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| **Comment #/Comment Received From:** #45/Colorado Parks and Wildlife (CPW), Bill DeVergie, Area Wildlife Manager |
| **Summarized Comment:** In general, CPW supports BLM's efforts to conduct feral horse gathers and implement fertility control measures to manage the Piceance-East Douglas herd size within the objectives set forth in the 1997 White River Field Office Resource Management Plan. |
| **BLM Response:** Comment noted. |

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| **Comment #/Comment Received From:** #46/Colorado Parks and Wildlife (CPW), Bill DeVergie, Area Wildlife Manager |
| **Summarized Comment:** The Piceance Basin contains Colorado's largest migratory mule deer population, and habitat for numerous other economically important species of wildlife. Overutilization of rangeland resources from increasing feral horse numbers (all-time population highs within the HMA) has the potential to affect CPW's management of big game populations at the levels established within herd management plans for this area. Additionally, recent drought conditions have exacerbated the efforts of overgrazing, and further stress the need for feral horse population control measures. |
| **BLM Response:** While the BLM recognized the concern regarding impacts of wild horses on rangeland communities, it is outside of the scope of this EA. The EA specifically addresses impacts associated with wild horse gather operations and implementation of fertility control |

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| measures. BLM’s goal is to manage wild horse populations within the Appropriate Management Level (AML) of 135-235 in the PEDHMA. |

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| **Comment #/Comment Received From:** #47/Colorado Parks and Wildlife (CPW), Bill DeVergie, Area Wildlife Manager |
| **Summarized Comment:** The PEDHMA also overlaps CPW-mapped greater sage-grouse (GrSG) habitats and occupied range. GrSG are obviously a species concern given range-wide declines over the last several decades. The Parachute/Piceance/Roan (PPR) population is on the periphery of the overall range for GrSG and an important conservation population to reduce further contraction of the species ‘occupied habitat. |
| **BLM Response:** Refer to Comment #46. BLM’s long term management goal (refer to Section 5.6.3) would be continuing to manage wild horses within the established AML range and to help achieve a thriving natural ecological balance and multiple use relationship on public lands in the area and not just within Greater Sage Grouse habitats. |

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| **Comment #/Comment Received From:** #48/Colorado Parks and Wildlife (CPW), Bill DeVergie, Area Wildlife Manager |
| **Summarized Comment:** Finally, as mentioned in the Preliminary EA, there are currently horses outside of the designed HMA boundaries. Specifically, feral horses are regularly observed to the east of the HMA within sage-grouse habitat that is highly important to the PPR population within the Black Cabin Gulch and Bar D Mesa Areas of the Piceance Basin. |
| **BLM Response:** Refer to Comment #46. Please refer to NEPA #DOI-BLM-CO-N050-2018-0071-DNA signed on February 14, 2020 for BLM’s decision regarding wild horses located outside of the PEDHMA. Refer to Section 5.3.2 Alternative C (No Action Alternative) – Direct and Indirect Effects. However, indirect effects from an increasing wild horse population would create competition (stresses from in-fighting) between each wild horse, between bands of wild horses, and the other ungulates over the various resources (forage, water, space, cover). If rangelands were allowed to continue to degrade, the wild horses would likely experience reduced body condition, and be less able to obtain the necessary resources to survive (considered a long-term effect). Wild horses unable to obtain the necessary resources to survive would likely expand into areas with available resources or may die of starvation and/or dehydration outside of the PEDHMA. |

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| **Comment #/Comment Received From:** #49/Colorado Parks and Wildlife (CPW), Bill DeVergie, Area Wildlife Manager |
| **Summarized Comment:** At the northeastern boundary of the HMA, there is overlap with CPW-owned State Wildlife Area properties (Yellow Creek and North Ridge). These properties |

contain over 4,000 unfenced acres and were purchased by CPW to provide habitat for native wildlife species and public land access for sportspersons. Overgrazing by feral horses is not compatible with the intended use of these properties.

**BLM Response:** See Comment #46. Again, BLM's goal is to manage wild horse populations within the entire PEDHMA including the areas of Yellow Creek and North Ridge. Also, refer to Comment #48. BLM's long term management goal (please refer to Section 5.6.3) would be continuing to manage wild horses within the established AML range and to help achieve a thriving natural ecological balance and multiple use relationship on public lands in the area, including lands owned by the State of Colorado.

**Comment #/Comment Received From:** #50/Individual, Joyce Smith

**Summarized Comment:** I do not believe wild horses should be gathered from this area and fracking increased.

**BLM Response:** This comment is outside of the scope of the EA. The use of fracking is a standard process related to energy development. Energy development is authorized through site-specific NEPA analysis completed on specific projects. This EA does not authorize energy development within the PEDHMA.

**Comment #/Comment Received From:** #51/Individual, Kirk Cunningham

**Summarized Comment:** I have two questions, however: 1. The map of the Horse Management Area does not seem to overlap much with the recent large fire in the general area, but does that fire damage affect this proposed management plan in any way?

**BLM Response:** Neither Figure 1 or 2 in Appendix A (Maps) include historical and/or recent fire mapping. If you are talking about the recent large fire referred to as the "Pine Gulch Fire" it was located near Grand Junction and had no impact to the PEDHMA.

**Comment #/Comment Received From:** #52/Individual, Kirk Cunningham

**Summarized Comment:** 2. Ideas for a new off-stream reservoir to replace the existing silted-up dam and reservoir on the White River upstream of Rangely might have a catchment area affected by grazing generally and horse grazing in particular. 3. Finally, and more controversially, the successful effort to approve the reintroduction of wolves to this state – hated by ranches, of course, - might be the only way to reducing the horse herd without the trouble and expenses of BLM's plan!

**BLM Response:** This comment is outside of the scope of this EA. 2. If you are referring to the White River Storage Project (aka Wolf Creek Reservoir) this proposed catchment is located on the north side of the White River well outside of the PEDHMA. 3. The reintroduction of wolves will be handled by Colorado Parks and Wildlife.

**Comment #/Comment Received From:** #53/Individual, Richard Karcich

**Summarized Comment:** The BLM currently estimates there are 838 wild horses inside the PEDHMA, which includes about 190,000 acres east of Colorado Highway 139, south of Colorado Highway 64 and west of Colorado Highway 13 versus COLORADO WILD HORSE AND BURRO AREAS ADMINISTRATED BY THE BUREA OF LAND MANAGEMENT as of March 1, 2020 which shows an estimated population for the HMA as 698 Wild Horses. (838-698)/838 = 17% difference <This difference calls into question each of the population estimates in the EA and requires resolution!

**BLM Response:** The estimated 698 population that you note is through the fall of 2019 and was reported by the National Program Office (NPO) for early 2020. That estimated 698 population does not include the 2020 recruitment of 20% or 139.6 (new foals) to come to an estimated population of 837.6 which is rounded up to 838.The BLM will use the best available information to evaluate potential impacts to resources and resource uses in the project area (PEDHMA).

**Comment #/Comment Received From:** #54/Individual, Richard Karcich

**Summarized Comment:** What is the basis for including a flat 20 percent foal increase was in each population estimate? There's no basis or citation anywhere in the EA for annual foal increase!

**BLM Response:** Refer to updated information in Section 1.1.2. The expected value of 20% per year annual herd growth rate takes into account both births (new foals) and deaths (of all age classes).

**Comment #/Comment Received From:** #55/Individual, Janet L.

**Summarized Comment:** I also strongly oppose the proposed plan to reduce the herd from approximately 838 wild horses to between 135-235 individuals. As usual, the BLM has failed to come up with scientific justification for its designation of so-called "appropriate" management levels. In fact, this enormous 190,000 acre area easily support the wild equines on it.

**BLM Response:** This comment is outside of the scope of this EA. The AML represents "that 'optimum number' of wild horses which results in a thriving natural ecological balance and avoids a deterioration of the range" (*Animal Protection Institute*, 109 IBLA 119 (1989). The IBLA has also held that, "Proper range management dictates removal of horses before the herd

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| size causes damage to the rangeland. Thus, the optimum number of horses is somewhere below the number that would cause resource damage." (*Animal Protection Institute*, 118 IBLA 63, 75 (1991). AML was established in a land use planning process. |

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| **Comment #/Comment Received From:** #56/Individual, Janet L. |
| **Summarized Comment:** What is required is a reasonable reduction in livestock grazing to environmentally sustainable levels. |
| **BLM Response:** Livestock forage reduction was included as an Alternative considered but not carried forward, refer to Appendix E, Section E.4. |

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| **Comment #/Comment Received From:** #57/Individual, Janet L. |
| **Summarized Comment:** Finally, while I support PZP as proven, efficacious, cost-effective and humane means of fertility control, I absolutely oppose permanent sterilization by either chemical or surgical means. Surgical sterilization in particular carries utterly unacceptable risks of serious complications and deaths, and I refuse to pay for such dangerous and inherently inhumane procedures with my tax dollars. |
| **BLM Response:** Please refer to Alternative A (Proposed Action) – Gather to the Low End of AML and *Use Non-Permanent* Fertility Control Treatments. The WRFO at this time does not propose to utilize permanent fertility control treatments. Allocation of funding appropriated by Congress is outside the scope of this EA. |

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| **Comment #/Comment Received From:** #58/Individual, Pam Nickoles |
| **Summarized Comment:** 1) Re-evaluate and increase the long-outdated AML for PEDHMA. Despite the number of horses that BLM currently claims reside within the HMA, the bands are healthy and routinely documented as such. The area can obviously support more animals than the current AML recommendation. HMA's were established predominantly for the protection of wild horses, not to graze cattle or sheep. The AML should reflect that. |
| **BLM Response:** Regarding AML, refer to the updated Section E. 3. in the EA and for the reasons at Appendix E. 3. Alternatives Related to Population Size or Structure. |

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| **Comment #/Comment Received From:** #59/Individual, Pam Nickoles |
| **Summarized Comment:** 2) Initiate a PZP (only) fertility control program utilizing the volunteer organization, Piceance Mustangs, which can help document herd size, bands and individual mares for darting. Give this new program time to effect benefits before implementing a round up after round up which is likely to trigger compensatory reproduction |

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| and fill up holding facilities with horses better managed on the range. There is the added benefit of reducing the cost burden to taxpayers who pay for the round up operations and the inhumane warehousing of wild horses. |
| **BLM Response:** Comment noted regarding use of PZP (only) fertility control program. The use of fertility control treatments would be used to reduce recruitment (growth) rate while gather operation(s) are conducted to reduce the population size from a given population level in a timely manner (refer to Section 1.2 Purpose and Need for the Proposed Action). Fertility treatment-only alternatives were considered by not analyzed in detail, as they would not achieve the purpose and need identified. |

| **Comment #/Comment Received From:** #60/Individual, Pam Nickoles |
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| **Summarized Comment:** 3) Should a roundup receive funding, use only water or bait trapping to reduce stress, cost and keep bands intact which will further facilitate herd documentation and PZP efforts. Return any older, less adoptable horses back into the HMA. |
| **BLM Response:** The use of bait trapping only at this time would not meet the needs to get the wild horse numbers down to low end of AML. This EA analyses the use of all approved gather methods and would when necessary conduct bait trapping operations. Documentation of wild horses is on-going due to limited volunteer involvement, the constant changes in bands, and the areas where individual wild horses are able to be within the PEDHMA. Refer back to Section 3.1 in the EA under Selective Removal and Augmentation regarding older wild horses. |

| **Comment #/Comment Received From:** #61/Individual, Pam Nickoles |
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| **Summarized Comment:** 4) For any horses that must be removed, consider creating a PEDHMA specific training program with trainers and a facility to assist in adoptions rather than warehousing; much like that of GEMS (Great Escape Mustang Sanctuary) and the Mantle Ranch in Wyoming. Ideally, this facility would be located within close proximity to the PEDHMA. In addition, offer on-location adoption opportunities after any gathers as these have proven to help more horses get adopted. |
| **BLM Response:** 4) Comment noted. BLM WRFO is working with the Meeker Mustang Makeover with another event scheduled for August 2021.<br><br>The WRFO continues to work with the Colorado Northwestern Community College (Rangely) Equine Program (as recent as February 2021) for developing a similar event to the Meeker Mustang Makeover for the college; working with/through the regional 4H equine programs (Rio Blanco, Routt, and Garfield Counties); as well as with Steve Mantle out of WY for setting up a local facility for training and adoptions. In the event that regional training and adoption programs are inadequate to place excess removed animals, some would enter the national WHB program’s placement program. |

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| **Comment #/Comment Received From:** #62/ Individual, Ron Brourman |
| **Summarized Comment:** The extremely low AML to which you proposed bringing these horses would reduce the herd level to such a low level that the herd would no longer be biologically viable. These levels are far lower than the ones specific in the original Wild Horse and Burro Act and they are patently unfair to the wild horses. |
| **BLM Response:** Refer to Section 5.3.1 for review of genetic diversity and viability as well as the impacts of fertility control treatments. New text has been added, in response to this and other comments. |

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| **Comment #/Comment Received From:** #63/ Individual, Ron Brourman |
| **Summarized Comment:** If you end up going ahead with this very ill-advised gather, we would have a small number of horses, many of which would be sterile. People who would otherwise want to visit the state of Colorado to view the wild horses in this area would realize that these few remaining horses would be a more or less sterile and nonviable herd masquerading as being in the wild. In short, it would turn this area into a glorified zoo. |
| **BLM Response:** At this time, within Colorado there is the Little Book Cliffs Wild Horse Range, Spring Creek Basin Herd Management Area, Sand Wash Basin Herd Management Area, and the Piceance-East Douglas Herd Management Area, all located on the western slope of Colorado, each offering wild horses on varied landscapes along with different foliage to view. Fertility control treatments have long been used in several of these HMAs, and there is evidence to show that tourists do continue to visit those areas. |

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| **Comment #/Comment Received From:** #64/Individual, Ron Brourman |
| **Summarized Comment:** In addition, the wild horses provide a number of ecological benefits which have been described by a number of noted wildlife ecologists, which include enriching the soil, foraging on the land in a way that promotes the sequestering of carbon and helping to mitigate wildlife, since the unique structure of their digestive system helps to promote the growth of native grasses. |
| **BLM Response:** Appendix G addresses ecological effects of wild horses. On the whole, a collection of peer-reviewed scientific studies indicates that overpopulated wild horse herds tend to contribute to rangeland degradation, rather than amelioration. |

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| **Comment #/Comment Received From:** #65/ Individual, Ron Brourman |

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| **Summarized Comment:** If you wish to keep the horses away from certain areas, a number of natural ways of implementing this including the use of the conservation technique known as Reserve Design, which incorporates natural barriers in certain strategically located sites. |
| **BLM Response:** Multiple use management objectives and decisions to implement management have been evaluated and issued through the land use planning process. Changes to these management decisions is outside the scope of this analysis. |

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| **Comment #/Comment Received From:** #66/ National Mustang Association Inc, Colorado (NMACO), David Temple |
| **Summarized Comment:** Whichever option BLM pursues, NMACO questions the basis of the AML set for the wild horses at 135-235. Did this decision include consideration of the 6935 AUMs for Cattle? If so, it should be reviewed and reconsidered before horses are removed, and AMLs for wild horses should be based upon objective, scientific data that is transparently available to the public. |
| **BLM Response:** Regarding AML, refer to the updated Section E. 3. in the EA and for the reasons at Appendix E. 3. Alternatives Related to Population Size or Structure. |

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| **Comment #/Comment Received From:** #67/NMACO |
| **Summarized Comment:** NMACO maintains that no gathers should be necessary if wild horses and burros were propertly managed in accordance with the Wild and Free Roaming Horse and Burro Protection Act of 1971. Private cattle on public lands outnumber wild horses by a ratio of 100 to one, an egregious imbalance of public and private interests. |
| **BLM Response:** Multiple use management objectives and decisions to implement management have been evaluated and issued through the land use planning process. Changes to these management decisions is outside the scope of this analysis. |

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| **Comment #/Comment Received From:** #68/ NMACO |
| **Summarized Comment:** NMACO supports (a) retirement or buyout of grazing leases in the PEDHMA (b) designation of the PEDHMA as a sanctuary, and (c) expanding the acreage available for wild horses into more of their historical habitat. Further there are several allotments that have cattle grazing during the spring growth period. This needs to be modified to dormant use only until these AUMs can be purchased or retired. This would further fulfill the purpose of the Taylor Grazing Act to "promote the highest use of the public lands" and to manage livestock grazing in a manner designed to stop the continued degradation to public lands. |

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| **BLM Response:** Decisions regarding multiple use management objectives within the PEDHMA and implementation of such management have been evaluated and issued through the land use planning process. Note that through the 1997 WRRA, Resource Area Management Plan, the boundary of the PEDHMA was expanded to include the Greasewood allotment (presently a part of the North Piceance Herd Area) and by EA WR-02-049 the Appropriate Management Level for wild horses went from 95-140 to 135-235 wild horses within the PEDHMA as referenced in the 2011 EA that we incorporated by reference at Section 1.1.1 of this EA. Changes to these management decisions are outside the scope of this analysis. |

| **Comment #/Comment Received From:** #69/NMACO |
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| **Summarized Comment:** It is well established that public opinion favors wild horses, and allowing four permittees to utilize the majority of the resources to the detriment of the range and the wild horses does not conform to the mandates of the Wild Horse Protection Act. If this imbalance is corrected, wild horses could be allowed to roam their historical habitat without frequent "gathers" and removals. NMACO recommends that the HMA be increased. |
| **BLM Response:** PEDHMA is not a designated wild horse range. For Colorado there is one wild horse range (Little Book Cliffs), and three wild horse Herd Management Areas that BLM currently manages for wild horse populations. 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 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." On PEDHMA, multiple use management objectives and decisions to implement management have been evaluated and issued through the land use planning process. Changes to these management decisions is outside the scope of this analysis. |

| **Comment #/Comment Received From:** #70/NMACO |
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| **Summarized Comment:** Therefore, NMACO questions BLM's estimate of the number of horses in the PEDHMA as well as the AML limits. These figures have been cited in the EA without substantiation, rendering the EA conclusions unsubstantiated as well. |
| **BLM Response:** Regarding AML, refer to the updated Section E. 3. in the EA and for the reasons at Appendix E. 3. Alternatives Related to Population Size or Structure. The estimated herd size (EA Table 1) is considered a minimum, because the 2016 aerial inventory led only to a raw count of the animals present. That method leads to known underestimation of the true population. |

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| **Comment #/Comment Received From:** #71/NMACO |
| **Summarized Comment:** NMACO recommends that BLM consider designating the Piceance-East Douglas HMA a sanctuary for the wild horses and legitimately retire grazing permits in the area. |
| **BLM Response:** Multiple use management objectives and decisions to implement management have been evaluated and issued through the land use planning process. Changes to these management decisions are outside the scope of this analysis. |

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| **Comment #/Comment Received From:** #72/NMACO |
| **Summarized Comment:** Bait trapping: With regard to gathering wild horses, if and when needed, NMACO strongly support the option of bait trapping over helicopter chases in the interest of the horses. Bait trapping, done properly, can habituate horses to humans and habituate wild horses to perceive humans as resources, rather than threats. Helicopter chases have the opposite result, and may create lifelong trauma for the horses that prevent successful domestication which then leads to more unwanted horses. |
| **BLM Response:** Comment noted that bait trapping is your preferred method which could affect future temperament of a wild horse that is gathered/removed and the likelihood for adoption failure. Refer to Appendix D. Animal Welfare Standards. |

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| **Comment #/Comment Received From:** #73/NMACO |
| **Summarized Comment:** NMACO recommends that BLM collaborate with wild horse advocacy groups and other private interests to buy out the grazing rights in the PEDHMA. |
| **BLM Response:** Livestock forage reduction was included as an Alternative Considered but Not Carried Forward, refer to Appendix E, Section E.4. The delineation of grazing authorizations was conducted through Land Use Planning decisions, and the grazing regulations at 43 CFR § 4130.2(g), BLM managers may approve, on an annual basis, applications for temporary nonuse, in whole or in part, for up to three consecutive years.<br><br>No advocacy group or grazing operator associated with the PEDHMA has identified any interest in either obtaining or selling the grazing rights from any of the grazing allotments located within the PEDHMA. |

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| **Comment #/Comment Received From:** #74/NMACO |
| **Summarized Comment:** NMACO supports the gathering of intact social groups in the best interest of the horses. |

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| **BLM Response:** Comment noted. |

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| **Comment #/Comment Received From:** #75/NMACO |
| **Summarized Comment:** NMACO would like BLM to ensure that the standards articulated in the CAWP be mandated for any and all personnel, contractors and volunteers participating in any gathers within or outside of the PEDHMA. |
| **BLM Response:** Refer to Appendix D. Animal Welfare Standards. Application of the standards is BLM policy (IM 2021-002), applicable to BLM, contractors, and other associated with gather activities. |

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| **Comment #/Comment Received From:** #76/NMACO |
| **Summarized Comment:** Genetic diversity: NMACO is concerned that the PEDHMA AML of 135-235 horses is inadequate to maintain healthy genetic diversity. |
| **BLM Response:** Refer to Section 5.3.1 for review of genetic diversity and viability as well as the impacts of fertility control measures. |

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| **Comment #/Comment Received From:** #77/NMACO |
| **Summarized Comment:** Re Fertility control: This could be accomplished in the PEDHMA in conjunction with the bait trapping.<br><br>As a further or complementary fertility control method, NMACO recommends that BLM consider the baiting and darting solution developed by Roch Hart of Wildlife Protection Management (www.wildlifepm.com). This system utilizes solar energy and satellites that can function remotely, and enables contraceptive darting, vaccination and microchipping remotely, and which could help obviate the need for continued frequent gathers. |
| **BLM Response:** New text has been added to the EA: "If the mechanism is shown to be safe and effective, BLM may consider use of an automated GonaCon-Equine dart delivery system (e.g., as developed by Wildlife Protection Management, New Mexico), pursuant to the development of additional SOPs." |

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| **Comment #/Comment Received From:** #78/NMACO |
| **Summarized Comment:** NMACO supports fertility control, but does not support sterilization. NMACO is concerned about the possible sterilization of mares with Gona-Con, so recommends further research before it is utilized in Piceance area. |

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| **BLM Response:** Refer to Appendix G.3 under Vaccine Formulations: Gonadotropin Releasing Hormone (GnRH) where it states: "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)". |

| **Comment #/Comment Received From:** #79/NMACO |
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| **Summarized Comment:** Place of gathered horses. NMACO strongly opposes removing more wild horses to long-term holding pens and supports utilizing other options such as private contracting for sanctuaries on large ranches, expanding herd areas and establishing sanctuaries on public herd areas.<br><br>Previously closed herd areas should be reopened for the benefit of wild horses. Fertility control would not be needed for horses returned from holding facilities, as stallions have [presumably] been gelded. |
| **BLM Response:** Short-term or long-term holding is outside of the scope of the EA. Multiple use management objectives and decisions to implement management have been evaluated and issued through the land use planning process. Changes to these management decisions are outside the scope of this analysis. |

| **Comment #/Comment Received From:** #80/Colorado Wild Horse and Burro Coalition (CWHBC), Barb Flores |
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| **Summarized Comment:** There is no provision in the Act for the establishment of HMAs, which exclude large portions of the original Herd Areas (HAs). The area being managed for wild horses in Piceance-East Douglas HMA, now excludes the North Piceance HA. |
| **BLM Response:** Multiple use management objectives and decisions to implement management have been evaluated and issued through the land use planning process (refer to 43 CFR § 4710.1). Changes to these management decisions are outside the scope of this analysis. |

| **Comment #/Comment Received From:** #81/Colorado Wild Horse and Burro Coalition (CWHBC), Barb Flores |
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| **Summarized Comment:** The application of the bogus Appropriate Management Level (AML) is not legal, as the National AML was a number negotiated between the BLM and the National Cattlemen's Beef Association (NCBA), per former Wild Horse and Burro Advisory |

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| Board member, Gary Zakotnik, and not determined by scientific methods to determine the actual carrying capacity to "maintain a thriving natural ecological balance". AML should be determined by monitoring each HA and determining its carrying capacity, not as a fraction of a number set at the national level first. |
| **BLM Response:** Regarding AML, refer to the updated Section E. 3. in the EA and for the reasons at Appendix E. 3. Alternatives Related to Population Size or Structure. AML in the PEDHMA was not determined as a fraction of any nationally determined value. Determination of appropriate AML levels are beyond the scope of this gather plan EA. |

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| **Comment #/Comment Received From:** #82/Colorado Wild Horse and Burro Coalition (CWHBC), Barb Flores |
| **Summarized Comment:** The current wild horse population is "estimated" to be 838 animals. As BLM assumes an annual recruitment rate of 20%, which is unsubstantiated by science and does not consider mortality rates, especially among horses one year old and younger, an actual aerial census needs to be done to support any removal of wild horses from the Piceance-East Douglas HMA. |
| **BLM Response:** Refer to Comment #32 and EA Table 1. Expected annual growth rates of 20% are comparable to those identified in a meta-analysis by Ransom et al. (2016). Mortality rates are included in these expected annual herd growth rates. Annual growth rates reflect additions to the herd from foaling, and losses to the herd from death. |

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| **Comment #/Comment Received From:** #83/Colorado Wild Horse and Burro Coalition (CWHBC), Barb Flores |
| **Summarized Comment:** An AML of 125-235 is unacceptable and AML needs to be determined, after removing all private livestock from the HMA and doing scientific monitoring to determine the true Appropriate Management Level. |
| **BLM Response:** Regarding AML, refer to the updated Section E. 3. in the EA and for the reasons at Appendix E. 3. Alternatives Related to Population Size or Structure. |

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| **Comment #/Comment Received From:** #84/Colorado Wild Horse and Burro Coalition (CWHBC), Barb Flores |
| **Summarized Comment:** … I could only support a gather that would result in all gathered mares receiving PZP or a comparable birth control drug, at the time of year when it needs to be administered to be effective, and then ALL gathered animals being released back onto their home range. There is no mention in the Preliminary EA of how many mares will received PZP. Please state that. |

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| **BLM Response:** Refer to updated text in the EA under Section 5.3.1 which suggests that the ability to have a specific number cannot be identified at this time. Once we are at AML and achieve and active fertility control treatment BLM would be able to specifically identify the number of animals to receive treatment. Please see Appendix E, which details alternatives considered but not analyzed in detail, including exclusive use of fertility control treatments. |

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| **Comment #/Comment Received From:** #85/Colorado Wild Horse and Burro Coalition (CWHBC), Barb Flores |
| **Summarized Comment:** … FLPMA requires "multiple use", but not all uses on all land, just multiple use of BLM lands as a total. Restricting livestock permits to lands not designated as HAs or HMAs would not be a violation of law. |
| **BLM Response:** The Federal Land Policy and Management Act of 1976 (FLMPA) requires that an action under consideration be in conformance with the applicable BLM land use plan, and be consistent with other federal, state, and local laws to the maximum extent possible. The decisions to implement management have been evaluated and issued through the land use planning process. Changes to these management decisions are outside the scope of this analysis. |

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| **Comment #/Comment Received From:** #86/Colorado Wild Horse and Burro Coalition (CWHBC), Barb Flores |
| **Summarized Comment:** I must object to the AML determination and the lack of efforts by BLM to correctly identify and protect OUR PUBLIC land from excessive livestock use. |
| **BLM Response:** Regarding AML, refer to the updated Section E. 3. in the EA and for the reasons at Appendix E. 3. Alternatives Related to Population Size or Structure. Land use decisions regarding livestock are covered under the multiple use management objectives and decisions to implement management have been evaluated and issued through the land use planning process. Changes to these management decisions are outside the scope of this analysis. |

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| **Comment #/Comment Received From:** #87/Colorado Wild Horse and Burro Coalition (CWHBC), Barb Flores |
| **Summarized Comment:** It was noted in the Preliminary EA that no horses would be gathered from outside of the HMA. I hope this is correct and that no West Douglas or North Piceance horses will be gathered as part of this action. |
| **BLM Response:** Refer to 1.5.3 This Determination of NEPA Adequacy (DNA) at #DOI-BLM-CO-N05-2018-0071-DNA signed on February 14, 2020 issued for areas that were |

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| previously evaluated through separate NEPA reviews (i.e., West Douglas Herd Area (WDHA) at #DOI-BLM-CO-N05-2015-0023-EA, includes the North Piceance Herd Area at #DOI-BLM-CO-N05-2017-0056-EA), and areas adjacent to the PEDHMA.<br><br>Refer to 1.5.2 regarding the DOI-BLM-CO-N050-2020-0040-CX removal of 75 wild horses from private lands within the PEDHMA (specifically within Greasewood Allotment). This Categorial Exclusion (CX) was completed on October 27, 2020. |

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| **Comment #/Comment Received From:** #88/Colorado Wild Horse and Burro Coalition (CWHBC), Barb Flores |
| **Summarized Comment:** Actually, roping should NEVER be an option. Horses should also not be run into pens, as too many hit the railings and suffer severe injury resulting in death. Any horse injured or killed as a result of gather methods used by a contractor should be cause for a penalty levied again that contractor. Three or more deaths during gathers conducted by that contractor should result in striking that contractor from all subsequent use by the BLM for gathering wild horses or burros. |
| **BLM Response:** Refer to Appendix D, Animal Welfare Standards, and BLM PIM 2021-002. |

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| **Comment #/Comment Received From:** #89/Individual, Kathe Kloberdanz |
| **Summarized Comment:** I am requesting urgently to have the impending Gather and Spaying of wild horses at Piceance range Halted. This and all forms of wild Sterilization are not managing herds it is meant to Eradicate OUR Public horses and burros. … If you REALLY care about the horses you are put in the care of you will not let the Spaying happen nor let mares be injected with poison PZP. Penned animals are to be humanely treated and handled with care. |
| **BLM Response:** Neither Proposed Alternatives A or B in this EA allows for permanent surgical sterilization to take place at this time. Refer to Appendix D, Animal Welfare Standards. PZP vaccine fertility control vaccine is regulated by the EPA because any mitigation of feral animal populations is subject to EPA oversight, under FIFRA. Despite this regulatory structure, PZP vaccines are not considered poisonous. |

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| **Comment #/Comment Received From:** #90/Individual, Pamela True |
| **Summarized Comment:** BLM's non-viable AML for the PEDHMA at the low end of 135 divided into 190,130 would be one horse per 1,410 acres and the high end of 235 would be one horse per 809 acres. |

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| **BLM Response:** Regarding AML, refer to the updated Section E. 3. in the EA and for the reasons at Appendix E. 3. Alternatives Related to Population Size or Structure.<br><br>The public land acreage within the PEDHMA (estimated at 158,310) equates to a 16.6 acres per Animal Unit Month (AUM). The forage allocation (for livestock and wild horses) is based on forage production and utility for an average year and is allocated to ensure adequate residual forage is available for wildlife species and plant health. The 16.6 acre/AUM is an average across all of the PEDHMA as some ecological sites are more productive than others, forage allocations also consider use periods and whether use will occur season long, or intermittently which provides opportunity for plant regrowth following grazing.<br><br>Changes to these management decisions is outside the scope of this analysis. |

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| **Comment #/Comment Received From:** #91/Individual, Pamela True |
| **Summarized Comment:** Plus, BLM states that they will be darting the mares returned with birth control and dart every mare every year going forward for the next 10 years and beyond.<br><br>… With the use of PZP and/or GonaCon there is a great change of permanent sterilization. Now it isn't rocket science to determine that this is a plan for extinction.<br><br>PZP has been proven to be very harmful for wild horses.<br><br>How does GonaCon work?<br><br>In the study done by Colorado State University in the Theodore Roosevelt National Forest, the majority of the mares darted with GonaCon showed injection site infections that festered as far as four years later within the study. |
| **BLM Response:** Refer to Appendix G regarding the known effects of fertility control treatments, including contraceptive efficacy and injection site reactions. Also, refer to Appendix D. Animal Welfare Standards. |

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| **Comment #/Comment Received From:** #92/Individual, Pamela True |
| **Summarized Comment:** BLM states that they test for DNA but say in the EA that they do not have to do that till some time much later down the road in the next 10 years and that testing often takes a year to get results. BLM also states that if they find DNA is low, then they introduce horses from other areas. This is also against the Wild Free Roaming Horse and Burro Act as the Wild Horses are to be considered on the land that they area found. Every HMA has their own unique genetics as they have acclimated to the unique ecosystems in which they reside. |
| **BLM Response:** Refer to Section 5.3.1 under Genetic Diversity and Viability, for more information regarding decisions on the introduction of any wild horses to the herd within the |

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| PEDHMA. Such a decision would depend on results from analyses of genetics samples. Because analysis is now conducted under a contract, genetic reporting is expected to be received in a more timely manner than was the case in the early 2000s. |

| **Comment #/Comment Received From:** #93/Individual, Pamela True |
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| **Summarized Comment:** BLM has not done any range management or assessment of this PEDHMA stated in the PEA. |
| **BLM Response:** Documentation regarding the determination of excess animals in the PEDHMA is included in Appendices B and C. Regarding AML, refer to the updated Section E. 3. in the EA and for the reasons at Appendix E. 3. Alternatives Related to Population Size or Structure. |

| **Comment #/Comment Received From:** #94/Wild Horse and Burro Fund (WHBF), Craig Downer |
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| **Summarized Comment:** I have just read through your Piceance-East Douglas wild horse gather and fertility control plan PEA of Nov. 2020. I am very much opposed to the proposed action as it gives lease consideration to the wild horses, whole legal area this is. I recommend that instead of cruelly and unwisely eliminating ca. 84$ of the 838 wild horses here you let these horses fill their ecological niche and self stabilize by employing the sound of Reserve Design. Given the 190,016 HMA acres, there are at present 227 HMA-acres, or 0.35 square mile, per individual wild horse. This is not at all "excessive" but is a modest population for this habitat and well within its carrying capacity. |
| **BLM Response:** Regarding AML, refer to the updated Section E. 3. in the EA and for the reasons at Appendix E. 3. Alternatives Related to Population Size or Structure. The PEDHMA has been designated for multiple uses through the land use planning process. Refer to Comment #90 regarding acreage needs per individual wild horse within the PEDHMA. |

| **Comment #/Comment Received From:** #95/Wild Horse and Burro Fund (WHBF), Craig Downer |
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| **Summarized Comment:** Your AML of just 135 to 235, mean 185, is not genetically viable & thwarts these wild horses from filling their ecological niche & playing their beneficial role. |
| **BLM Response:** Section 5.3.1 for review of genetic diversity and viability as well as the impacts of fertility control measures. |

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| **Comment #/Comment Received From:** #96/Wild Horse and Burro Fund (WHBF), Craig Downer |
| **Summarized Comment:** I implore you to reconsider this proposal & to do an Environmental Impact Study on this plan. |
| **BLM Response:** Based upon a review of the EA and the supporting documents, BLM determined that the Proposed Action will not have a significant effect on the quality of the human environment, individually or cumulatively with other actions in the general area. |

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| **Comment #/Comment Received From:** #97/Wild Horse and Burro Fund (WHBF), Craig Downer |
| **Summarized Comment:** Also I urge you NOT to implement PZP and GonaCon fertility control, as it has been proven that these have terrible disruptive effects upon the wild horses & their survival. Concerning PZP and its negative consequences for the horses, see my article https:\\www.horsetalk.co.nz/2020/03/24/pzp-wild-horses-do-not-belong-together Also see Kirkpatrick, J.F. et. Al. 2011. Contraceptive vaccines for wildlife: a review. American Journal of Reproductive Immunology 66(1):40-50. |
| **BLM Response:** Refer to Appendix G.3 Effects of Fertility Control Vaccines and Sex Ratio Manipulations for the scientific literature reviews. Appendix G identifies and addresses many of the topics that this commenter discusses in the web-based resource he refers to. The article by Kirkpatrick et al. (2011) was cited in the review in Appendix G. |

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| **Comment #/Comment Received From:** #98/Wild Horse and Burro Fund (WHBF), Craig Downer |
| **Summarized Comment:** I would be happy to work with you to draft a Reserve Design plan that honors the true nature of the horses in this intriguing habitat. |
| **BLM Response:** Multiple use management objectives and decisions to implement management have been evaluated and issued through the land use planning process. Changes to these management decisions is outside the scope of this analysis. |

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| **Comment #/Comment Received From:** #99/Return to Freedom (RTF), Neda DeMayo/Celeste Carlisle/Cory Golden |
| **Summarized Comment:** Why is PZP-22 being treated differently than GonaCon? |
| **BLM Response:** Refer to 5.3.1 where BLM notes that the WRFO's preference will be to use GonaCon-Equine (treatment to be done at the optimal time for highest rate of effectiveness) because of the suppression of estrus in the treated mares successful treatment has the potential |

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| to reduce fighting over the mare, and less mounting of the mare, along with increased effectiveness after receiving a booster dose (Rutberg et al. (2017) showed that PZP-22 vaccine pellets do not lead to such long-lasting effects, even after a booster dose), potentially longer lasting contraceptive effects, and simplicity of application in the field in that you don't have to keep the vaccine frozen or mixing. It is unlikely that every mare would receive fertility control treatments due to the gathering of the wild horses or locating the wild horses to treat in the field. All of this is generally due to the difficulties in locating the wild horses within the PEDHMA and how many opportunities there will be to deliver a successful treatment. |

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| **Comment #/Comment Received From:** #100/ Return to Freedom (RTF), Neda DeMayo/Celeste Carlisle/Cory Golden |
| **Summarized Comment:** It raises eyebrows, however, to demand demonstrations of utility and effectiveness of one type of vaccine more so than another, and begs the question: is the BLM showing favoritism to an internally developed and manufactured vaccine, and if so, why? |
| **BLM Response:** The EA suggested that GonaCon-Equine is the preferred fertility control vaccine for our area due to the topography, approachability of animals, and multiple year effectiveness after receiving the booster dose not because there is favoritism by a developer and/or manufacturer. Refer to BLM's response to the previous comment. GonaCon-Equine was not developed and is not manufactured by BLM. |

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| **Comment #/Comment Received From:** #101/ Return to Freedom (RTF), Neda DeMayo/Celeste Carlisle/Cory Golden |
| **Summarized Comment:** "Decreasing the numbers of excess wild horses on the range is consistent with findings and recommendations from the National Academy of Sciences (NAS), American Horse Protection Association (AHPA), the American Association of Equine Practitioners (AAEP), Humane Society of the United States (HSUS), Government Accountability Office (GAO), Office of Inspector General (OIG) and current BLM policy." (EA, p. 1) This is a rather simplified and misleading statement. These various organizations have all made statements, and do all have concerns, about wild horse management on public lands. Each of these organizations, however, is coming at the issue from a slightly different angle, and with slightly different degrees of experience and knowledge. The Humane Society of the United States, along with RTF and other stakeholder groups, have submitted a strategy that is based upon four management techniques being utilized simultaneously to stabilize and recue, where necessary, wild horse and burro populations. One of the four management techniques is in the short term, conducting targeted removals coupled with fertility control vaccines that are administered to at 90% of the mares remaining on the range. This would allow for slower gather and removal scenarios in the future. Nuances like this are not capture – they are, in fact, ignored – with sweeping statements about how all manner of organizations |

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| support the inaccurate idea that horses seem to be the single most dramatic cause of damage and deterioration on our rangelands. |
| **BLM Response:** Commented noted. Alternatives A and B in the EA support multiple methods of managing wild horse populations on the range. In deference to the nuances raised by this comment, the HSUS has been removed from the list of organizations mentioned. |

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| **Comment #/Comment Received From:** #102 Return to Freedom (RTF), Neda DeMayo/Celeste Carlisle/Cory Golden |
| **Summarized Comment:** While we recognize that this is the reality of the situation, we would caution that the starting and stopping of implementing and scaling up fertility control projects alongside gathers necessitates a solid, reliable program if it is to be successful.<br><br>This field office realizes this approach well by preparing to engage in a multitude of options to administer a vaccine: some use of vaccines on gathered horses that are then released; some use in trapped horses who are inoculated and released; and some via foot darting, when and where appropriate. |
| **BLM Response:** Comment noted. |

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| **Comment #/Comment Received From:** #103/ Return to Freedom (RTF), Neda DeMayo/Celeste Carlisle/Cory Golden |
| **Summarized Comment:** 1. Avoid, if possible, helicopter gather operations from late-August through November for high public use areas during big game hunting seasons. 2. If possible, the BLM would avoid helicopter gather operations from 12/28/2020 2/2 December 1 through February 28 to reduce/eliminate impacts to big game during the critical winter period. 3. If possible, the BLM would avoid helicopter gather operations from July 1 through August 15 to reduce/eliminate impacts to nesting raptors and migratory birds." (EA, p. 17). This would seem to leave only March, April, May, and June, which is the restricted period for helicopter gathers, due to foaling season. |
| **BLM Response:** Regarding Section 3.1.2 under Helicopters: #1, #2 and #3 are commitments to not utilizing the helicopter during those dates if at all possible, however, some helicopter gather operations do take place during these dates. Please see the updated information under 3.1.1 Gather Methods, #1 last sentence to clarify the helicopter use period. Also, under #2 the addition of the work not to the sentence: note that it says No helicopter-assisted roping would be conducted between the dates of March 1 and June 30 due to the BLM's policy which prohibits the capture of wild horses by helicopter during peak foaling periods. |

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| **Comment #/Comment Received From:** #104/ Return to Freedom (RTF), Neda DeMayo/Celeste Carlisle/Cory Golden |
| **Summarized Comment:** The use of any new fertility controls would employ the most current best management practices and humane procedures available for the implementation of the new controls. We assume this could eventually include several forms of surgical spay, as well as vaccines, when and if they are developed. We understand that an EA should evaluate all potential options, and use this opportunity to express that we do not support any surgical sterilization of animals for management purposes. |
| **BLM Response:** Neither Alternative A nor B request the use of permanent fertility control treatments to be utilized. Future NEPA analyses would need to be undertaken in order to add this type of fertility control treatment to wild horses within the PEDHMA. |

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| **Comment #/Comment Received From:** #105/ Return to Freedom (RTF), Neda DeMayo/Celeste Carlisle/Cory Golden |
| **Summarized Comment:** Because of the nature of the EA, with discussions of immune-contraceptive application and the inference that, due to circumstances that may change over time, various fertility control vaccines could be administered, we respectfully submit if one type of vaccine has already been implemented to control population growth rates, to switch to another immune-contraceptive vaccine would result in the loss of viable data. Efficacy and/or any potential long-term studies about behavior, side effects (or lack thereof), or outcomes will no longer be possible, since there will be no way to determine which vaccine was efficacious, etc. Further, there are no studies to provide validation that adding a second immune-contraceptive vaccination type to an individual mare is safe. |
| **BLM Response:** The EA identified that the preferred fertility control treatment would be via the GonaCon, and that PZP vaccines may also be used. Application of a different vaccine may occur depending on the local BLM management objectives. Although monitoring data will be collected in the course of fertility control operations, BLM does not consider application of those methods in PEDHMA to constitute a study. |

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| **Comment #/Comment Received From:** #106/Brieanah Schwartz, American Wild Horse Campaign (AWHC) |
| **Summarized Comment:** AWHC supports the BLM's proposed use of PZP fertility control vaccine in the PEDHMA. AWHC supports the application of in field application of PZP, including the use of bait trapping to apply fertility control. AWHC supports the agreement with Piceance Mustangs and using volunteers to apply fertility control. |
| **BLM Response:** Thank you for the comment. This EA analyzes the implementation of a field darting program utilizing BLM and authorized volunteers. |

| **Comment #/Comment Received From:** #107/AWHC |
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| **Summarized Comment:** AWHC strongly opposes the gather to low AML of 135. If wild horses need to be removed, bait trapping is the preferred method, as has been done in other HMA's. |
| **BLM Response:** Regarding AML, refer to the updated Section E. 3. in the EA and for the reasons at Appendix E. 3. Alternatives Related to Population Size or Structure. |

| **Comment #/Comment Received From:** #108/AWHC |
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| **Summarized Comment:** BLM could manage the PEDHMA wild horses at the "minimal feasible level" with the incremental removals and a comprehensive PZP program. |
| **BLM Response:** Alternative A identified the use of gather/removal and fertility control treatment. The proposed action would gather and remove excess wild horses to the extent feasible, from within the PEDHMA over a period of 10 years, in conjunction with fertility control treatments, to achieve and maintain the herd within AML. It is expected that gather efficiencies, funding, and holding space would not allow for attainment of the low AML during the initial gather. Therefore, multiple gathers over a period of 10 years could occur to achieve management objectives. Some readers may consider this to be an incremental approach. It is not logistically feasible to gather large numbers of animals on order to only remove a very small category of animals (i.e., animals of a very limited age class). Such an approach is cost-prohibitive and would require a greater number of gather occasions per animal than proposed under the action alternatives. |

| **Comment #/Comment Received From:** #109/AWHC |
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| **Summarized Comment:** BLM should consider increasing the AML when conditions are right to do so. |
| **BLM Response:** Regarding AML, refer to the updated Section 3.4. in the EA and for the reasons at Appendix E. 3. Alternatives Related to Population Size or Structure. Determinations of the appropriate AML range are beyond the scope of this gather EA. |

| **Comment #/Comment Received From:** #110/AWHC |
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| **Summarized Comment:** The BLM must consider the possibility of implementing a vigorous PZP program at the current population levels utilizing Catch, Treat, and Release methods of all mares over 1 year old using PZP-22 or PZP. |

**BLM Response:** This comment is analyzed within the EA. See section 3.1- *Fertility Control Treatments.* Use of fertility control only without removal of excess wild horses would be inconsistent with the WFRHBA because it would not allow for achievement of AML or result in a thriving natural ecological balance, because the herd size would remain excessive, with respect to AML, with concomitant negative effects on the natural environment.

**Comment #/Comment Received From:** #111/AWHC

**Summarized Comment:** BLM must analyze PZP as it pertains to NAS recommendations that removals likely keep populations at a level to maximize reproduction and NAS found the most promising methods of fertility control are PZP vaccines, GonaCon, and chemical vasectomies (Stallions)

**BLM Response:** Fertility control vaccines are considered and are part of the preferred alternative. See section 3.1- *Fertility Control Treatments.* If the commenter is trying to imply that the NAS (2013) made blanket recommendations against gathers and removals, that would be a mischaracterization. The NAS report did note the possibility for a relative increase in annual growth rates after some gathers, which is conceivable in areas where increased forage and water availability for mares that remain on an HMA can lead to increased per-capita fertility rates. That phenomenon is not a universal expectation after gather activities. Regardless, under the proposed action, the annual population growth rate is expected to be lower after the population size is reduced to be within the range of established AML and mares are returned to the range after fertility control treatments. The action of fertility control treatments should reduce per-capita fertility rates for the duration of the treatments' effectiveness. The current EA does not analyze in detail permanent fertility control techniques. The findings of the NAS report (2013) are included in the literature review in Appendix G with respect to PZP and GonaCon vaccines.

The NAS report (2013) suggested that chemical vasectomy (reviewed in: Fesseha, F. 2017. A review on nonsurgical sterilization methods in male animals. Veterinary Medicine Open Journal 3:VMOJ-19-114.), which has been developed for dogs and cats, may be appropriate for wild horses and burros, but results from a study after the 2013 NAS report (Collins, G. H., and J. W. Kasbohm. 2016. Population dynamics and fertility control of feralhorses. Journal of Wildlife Management 81: 289-296.) indicated that chemical vasectomy failed to block sperm transport in the treated animals (Scully, C. M., R. L. Lee, L. Pielstick, J. Medlock, K. M. Patton, G. H. Collins, and M. A.
Kutzler. 2015. Comparison of chemical and surgical vasectomy on testicular activity in free-roaming horses (*Equus caballus*). Journal of Zoo and Wildlife Medicine 46:815–824.). For that reason, and despite the NAS report (2013) suggestions, chemical vasectomy has not generally been considered for use by the BLM because of the poor outcome in that published study.

**Comment #/Comment Received From:** #112/AWHC

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| **Summarized Comment:**The NAS concluded that the only method available for use now without further research is the PZP birth control vaccine. |
| **BLM Response:** The commenter mischaracterizes recommendations in the 2013 NAS report. A scientific literature review was included in the EA which included a section on fertility control vaccines. See Appendix G.3.1. That review notes the many studies that have been published since 2013, including those that address concerns raised in the 2013 NAS report. The 2013 NAS report did not make recommendations precluding the use of a number of fertility control methods. For example, while the 2013 NAS report noted that it was a drawback that IUDs available at that time tended to become dislodged, recent study showed that Y-shaped, silicone IUDs stayed in mares at acceptable rates (reviewed in Appendix G.5). |

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| **Comment #/Comment Received From:** #1143AWHC |
| **Summarized Comment:** BLM is asked to add a newly published study on the implementation of PZP-22 by bait trap and darting to the analysis. (AWHC Attachment 2). |
| **BLM Response:** This study is included in the scientific literature review in Appendix G.3.1. |

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| **Comment #/Comment Received From:** #114/AWHC |
| **Summarized Comment:** BLM must consider and analyze how it could work with the Piceance Mustangs group in order to both implement and track mares receiving PZP in the PEDHMA in order to make such a program a success. |
| **BLM Response:** BLM does have a signed MOU with Piceance Mustangs. Specifics of how this partnership would work in the implementation of a fertility control program in Section 3.1.3. |

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| **Comment #/Comment Received From:** #115/AWHC |
| **Summarized Comment:** AWHC urges the BLM to use additionally appropriated funds to implement a comprehensive fertility control program in the PEDHMA. |
| **BLM Response:** Implementation of fertility control application is part of the proposed action. |

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| **Comment #/Comment Received From:** #116AWHC |
| **Summarized Comment:** Before the BLM implements utilization of GonaCon, the long term efficacy, safety, and impacts on wild horses need to be analyzed and disclosed. |

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| **BLM Response:** A scientific literature review in Appendix G.3.1 includes the impacts of GonaCon-Equine on wild horse mares. The potential effects considered efficacy (including of repeated doses), safety, and impacts on wild horses. More scientific publications about effects of GnRH vaccines have been made available since the 2013 NAS report suggested that such studies would be worthwhile. In this EA, potential effects were considered in light of currently available scientific literature, which is sufficient to make inferences about likely outcomes of vaccination with GonaCon-Equine. |

| **Comment #/Comment Received From:** #117/AWHC |
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| **Summarized Comment:** More research on the impacts of GonaCon needs to be completed before its broad use as a fertility control vaccine in wild horses. |
| **BLM Response:** A scientific literature review in Appendix G.3.1 includes the impacts of GonaCon -Equine on wild horse mares. More scientific publications about effects of GnRH vaccines have been made available since the 2013 NAS report suggested that such studies would be worthwhile. Potential effects were considered in light of currently available scientific literature, which is sufficient to make inferences about likely outcomes of vaccination with GonaCon-Equine. |

| **Comment #/Comment Received From:** #118/AWHC |
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| **Summarized Comment:** GonaCon should be dropped for consideration for utilization due to a variety of unknowns including association with abortion, long term physiological effects, its reversibility, and short term social/behavioral effects. |
| **BLM Response:** A scientific literature review in Appendix G.3.1 includes the impacts of GonaCon-Equine on wild horse mares. The potential effects considered include effects on existing pregnancies, physiological effects, reversibility, and behavioral effects. Those potential effects were considered in light of currently available scientific literature, which is sufficient to make inferences about likely outcomes of vaccination with GonaCon-Equine. |

| **Comment #/Comment Received From:** #119/AWHC |
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| **Summarized Comment:** Removing to low AML of 135 should be eliminated from further analysis as it would reduce the population to unnaturally low levels and maximize population growth rates as determined by NAS. |
| **BLM Response:** Wild horse population objectives would be managed according to the approved RMP. A herd size of 135 that includes some mares treated with fertility control vaccines and IUDs is expected to continue to be self-sustaining. |

| **Comment #/Comment Received From:** #120/AWHC |
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| **Summarized Comment:** Analyze impacts of drastic reduction of population size on population growth rate. |
| **BLM Response:** The comment very likely refers to concerns about the possibility for a relative increase in annual growth rates, which is possible in areas where increased forage and water availability for mares that remain on an HMA can lead to increased per-capita fertility rates. That phenomenon is not a universal expectation after gather activities. Regardless, the annual population growth rates is expected to be lower after the population size is reduced to be within the range of established AML and mares are returned to the range after fertility control treatments. The action of fertility control treatments should reduce per-capita fertility rates for the duration of the treatments' effectiveness. |

| **Comment #/Comment Received From:** #121/AWHC |
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| **Summarized Comment:** Analyze impacts of drastic population reduction on genetic health of the populations within the PEDHMA |
| **BLM Response:** The effects of maintaining the herd within established AML, including the use of fertility control measures, was analyzed in the EA. Additional text has been added to section 5.3.1 in response to this and other comments regarding genetic diversity. The herd would continue to be at numbers of 135 (low AML) or more. The BLM would continue to monitor genetic diversity of wild horses remaining in the HMA through DNA sampling in keeping with WO-IM 2009-062. If genetic diversity, as measured by observed heterozygosity, is found to be excessively low, then periodic introductions of additional wild horses would augment genetic diversity, as addressed in Section 3.1 Selective Removal and Augmentation in the EA.<br><br>Because of history, context, and periodic introductions, wild horses that live in the PEDHMA 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. In the specific case of the PEDHMA, the ancestry of horses in this area is of mixed origin from a number of domestic breeds commonly used in the region (Cothran 2010). These animals are part of part of a larger metapopulation (NAS 2013) that has demographic and genetic connections with other BLM-managed herds in Colorado, and beyond.<br><br>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 |

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| 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, R., J. D. Ballou, and D. A. Briscoe. 2010. Introduction to conservation genetics, second edition. Cambridge University Press, New York, New York.). Fst values for the PEDHMA herd had pairwise Fst values that were less than 0.075 with 77 other sampled herds. These results support the interpretation that PEDHMA horses are components in a highly connected metapopulation that includes horse herds in many other HMAs. |

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| **Comment #/Comment Received From:** #122/AWHC |
| **Summarized Comment:** Analyze direct impacts of helicopter drive trapping to the environment and the horses. |
| **BLM Response:** Direct impacts of helicopter drive trapping activities to wild horses and the environment are analyzed in Section 5 of the EA, and in Appendix G.1 (new text added in response to this comment). |

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| **Comment #/Comment Received From:** #123/AWHC |
| **Summarized Comment:** Analyze economic and welfare concerns related to increasing the off-range holding population of wild horses. |
| **BLM Response:** Long-term holding of wild horses is organized, conducted, and funded at a national level. This is outside the scope of this EA. |

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| **Comment #/Comment Received From:** #124/AWHC |
| **Summarized Comment:** Removing 703 wild horses would not be in line with the requirements of the WFRHBA that the BLM manage wild horses at the minimum feasible level. |
| **BLM Response:** Management of wild horses and burros should be accomplished at the minimum feasible level to maintain a thriving natural ecological balance. The continued presence of excess wild horses is not consistent with maintaining a thriving natural ecological balance. Removing 703 wild horses, and other actions to achieve and maintain the herd within AML, would support maintaining a thriving natural ecological balance with multiple uses in this area. |

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| **Comment #/Comment Received From:** #125/AWHC |

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| **Summarized Comment:** It appears that the BLM is explaining that one of the main factors illustrating that an overpopulation of wild horses exists in the PEDHMA is due to the private landowner requests the agency has received asking for the removal of horses. However, as the memo notes, the BLM has clear direction under Section 4 of the WFRHBA on when it can remove wild horses from private lands. Such removal requests in no way meet Section 3 standards for an excess determination. As such, it must be made clear in the Final EA that the BLM's Section 4 authority is wholly separate from the BLM making an excess determination under Section 3 of the WFRHBA. |
| **BLM Response:** The EA documents that excess wild horses exist within the PEDHMA (Appendix B & C). Part of the documentation for that determination falls under Sections 3 and 4 of the WFRHBA Section 1.5.1 discusses statutes and regulations that supports gathering excess wild horses from the PEDHMA, including the WFRHBA. |

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| **Comment #/Comment Received From:** #126/AWHC |
| **Summarized Comment:** The defined scope of this project is management of those wild horses found squarely within the PEDHMA, the Final EA must accurately reflect an excess determination based on only the wild horses found within the HMA boundary and not subject to Section 4 removal. |
| **BLM Response:** Private lands are also contained within the PEDHMA. Gather operations may fall under both Section 3 & 4 of the WFRHBA. Refer to Section 1.5.2. Other Gather Plans in the PEDHMA categorical exclusion (NEPA) DOI-BLM-CO-N050-2020-0040-CX for a Section 4 gather. That gather operation in no way impacts BLM's Section 3 excess determination here. |

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| **Comment #/Comment Received From:** #127/AWHC |
| **Summarized Comment:** This EA is partially describing an experiment, the BLM must remove the use of IUDs from the chosen action or follow the guidance of the federal Office of Research Integrity |
| **BLM Response:** BLM may observe and monitor the wild horses under its management purview after conducting management actions, including the use of PZP vaccine, GonaCon, sex ratio skewing, or IUDs, but any such observations would be a part of management activities, and would not part of any planned or prospective research study. The proposed actions are not part of any experimental study. The commenter's suggestion to that effect is misinformed or misinterpreting the BLM's planned management actions. Use of IUDs would be part of fertility control application as a part of wild horse management, as has been done in the Swasey herd management area of Utah. It is standard practice that BLM monitor the results of management actions, but this does not make those actions experimental. Monitoring and learning from actions is a potentially useful part of effective land management. There was no mention in the EA of IUD use as part of any study. There is no affiliation with any research institution to conduct any such study as part of the proposed management actions. The BLM is |

not required to seek the oversight of any institutional animal care and use committee for management applications of a fertility control method.

**Comment #/Comment Received From:** #128/AWHC

**Summarized Comment:** The EA is absent of any real detail or explicit protocols for implementation of the IUDs in wild mares. At the very least, when the BLM abandons this management decision and instead pursues a study, an IACUC will insist on clearly articulated protocols for the implementation and study of IUDs in wild mares of the PEDHMA.

**BLM Response:** Please see response to previous Comment #128. The BLM is not required to seek the oversight of any institutional animal care and use committee for management applications of a fertility control method.

SOPs for IUD use, which is a veterinary procedure, have now been included in a new appendix (Appendix H) in the EA. These methods were already described in general terms in Appendix G, but the inclusion of these veterinary details may be of interest to the public.

**Comment #/Comment Received From:** #129/AWHC

**Summarized Comment:** The proposed action is simply a thinly disguised, and poorly composed research experiment, takes action to implement an experiment only as part of a well designed, rigorously-controlled and documented scientific study conducted in conjunction with a reputable scientific institution, and then receives IACUC approval from that institution, it cannot accurately describe the proposed action or analyze its true impacts.

**BLM Response:** It is not clear what experiment the comment is referring to, although it may be taken from some other proposed BLM action not included in the PED HMA. Please see response to comment #128. The potential application of IUDs in the PED HMA would be part of a management action, based on available evidence on IUD efficacy and safety, as reviewed in appendix G. There is adequate information available to the extent that use of IUDs – a long-established method in equine management, and one that is improved by the development of Y-shaped silicone IUDs – is not scientifically controversial. The BLM has already used IUDs in a management application in the Swasey HMA in Utah. Use of IUDs in PED HMA is not part of any planned study and does not require or have any planned oversight from any university's IACUC, nor any involvement of a university to study outcomes.

**Comment #/Comment Received From:** #130/AWHC

**Summarized Comment:** If the BLM chooses to move forward with the implementation of IUDs as a management tool in the PEDHMA, then the agency must develop clear and precise protocols similar to those included for PZP and GonaCon. Without clear protocols for use, neither the agency nor the public can begin to properly analyze and consider the use of IUDs on the wild mares in the PEDHMA. Without these additions, the EA is considered incomplete.

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| **BLM Response:** SOPs for IUD use, which is a veterinary procedure, have been added, and are now included as a new appendix (in Appendix H) in the final EA. These methods were already described in general terms in Appendix G, but the inclusion of these veterinary details may be of interest to the public. The methods are the same as those used in other BLM management application of IUDs in wild mares that were returned to the range. |

| **Comment #/Comment Received From:** #131/AWHC |
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| **Summarized Comment:** The proposed roundup and removal will add wild horses and burros to taxpayer-funded holding facilities. Instead, a comprehensive field-darting fertility control program will save the agency, and taxpayers, money while managing the horses humanely. |
| **BLM Response:** Long-term holding of wild horses is organized, conducted, and funded at a national level. This is outside the scope of this EA. Application of fertility control is part of the proposed action. |

| **Comment #/Comment Received From:** #132/AWHC |
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| **Summarized Comment:** The option to implement vaccine-based fertility control before, and perhaps even in place of a roundup and removal action, is not only cost-effective but also in line with the wishes of the majority of American taxpayers and many members of Congress |
| **BLM Response:** Application of fertility control is part of the proposed action. Not removing horses to reach AML would not address the Purpose and Need for Action in Section 1.2 of the EA, because it is not acceptable to allow excess horses to remain on and outside of the HMA, as the excess numbers have a negative consequence on a thriving natural ecological balance. |

| **Comment #/Comment Received From:** #133/AWHC |
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| **Summarized Comment:** BLM must analyze all reasonable alternatives to the proposal, which the BLM has failed to do. |
| **BLM Response:** The WRFO considered a variety of alternatives, only three were carried forward for detailed analysis. See Sections 3 and 4 in the EA for detailed discussion for alternatives analyzed and alternatives not carried forward for detailed analysis. |

| **Comment #/Comment Received From:** #134/AWHC |
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| **Summarized Comment:** Instead of implementing a proposed action that includes roundups and removals, AWHC suggests that the BLM humanely manage wild horses through the application of PZP. |
| **BLM Response:** Application of fertility control is part of the proposed action. Not removing wild horses to reach AML would not address the Purpose and Need for Action in Section 1.2 of the EA. The continued presence of excessive horses is not consistent with maintaining a thriving natural ecological balance. Please see Appendix E to read about alternatives considered but not analyzed in detail. |

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| **Comment #/Comment Received From:** #135/AWHC |
| **Summarized Comment:** BLM should analyze a Catch Treat and Release (CTR) method without mass removals to low AML. |
| **BLM Response:** Gathers that include catching, treating, and releasing (CTR) (also called Gather and Release All) some animals are part of this EA. See section 3.4 at E.2. Also Appendix E provided further details on why this alternative was not considered in detail. Relying only on such CTR methods would not meet the purpose and need. The continued presence of excess wild horses is not consistent with maintaining a thriving natural ecological balance, and fertility control alone cannot reduce herd size over a reasonable time frame. For this reason, some gathers with removals are also required to meet the purpose and need. |

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| **Comment #/Comment Received From:** #136/AWHC |
| **Summarized Comment:** If roundups or trapping efforts are used to vaccinate mares, then the EA should clarify what CTR protocols it would implement under the proposed action as well. |
| **BLM Response:** Catch, Treat and Release (CTR) gathers are part of this EA. See section 3.1-Fertility Control Treatments. Application of fertility control would be conducted in the same manner as normal gather operations. |

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| **Comment #/Comment Received From:** #137/AWHC |
| **Summarized Comment:** It is reasonable for the BLM to also provide a breakdown of costs associated with the implementation of a comprehensive field darting fertility control program. |
| **BLM Response:** Costs/Economics are not analyzed in detail, as the Wild Free Roaming Horses and Burros Act (WFRHBA) does not authorize a cost-based decision-making process if excess horses are present. "Proper range management dictates removal of horses before the herd size causes damage to the range land (Animal Protection Institute. Of Am., 118 IBLA 75, *75 (Feb. 22, 1991))." BLM has a responsibility per the WFRHBA to remove excess wild horses, ensuring the health of wild horses and the rangeland. In addition, as costs do not |

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| respond to the purpose and need (Section 1.2) of the EA they are not carried forward for analysis within the EA. |

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| **Comment #/Comment Received From:** #138/AWHC |
| **Summarized Comment:** The BLM could also analyze and discuss how a public/private partnership, with a volunteer group such as Piceance Mustangs, for a fertility control program in the HMA would help defray costs. Importantly, the EA's analysis must also ultimately compare the cost and savings breakdown of a field darting fertility control program to the costs of roundup, removal and stockpiling horses for the remainder of their lives. |
| **BLM Response:** BLM discusses volunteers and partnerships in the section title Other Management Factors. This includes construction of range projects. Additional information pertaining to the in the field application of fertility control by volunteers and tasks that they may be asked to assist with are detailed in section 3.1.3. See comment #33 for discussion on cost analysis and cost savings pertaining to wild horse gathers and holding. |

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| **Comment #/Comment Received From:** #139/AWHC |
| **Summarized Comment:** The BLM should pursue analysis of an alternative that considers how the agency could accommodate a larger wild horse population through adjustments to livestock stocking rates with options such as voluntary grazing retirement opportunities. Such options should be explored with permittees in order to determine an equitable means to achieve a fairer allocation of resources for wild horses on public lands. |
| **BLM Response:** The 2011 EA analyzed this comment under Alternative C, which allowed for an increase to the wild horse population until a TNEB within the PEDHMA would be threatened and allotted AUM's for both wild horses and livestock would be consumed exclusively by wild horses. It was estimated in the 2011 EA, that the population would be approximately 791 wild horses, and would require removing 158 wild horses every year if no fertility control were applied. To see a full analysis on that alternative and the final determination see the 2011 EA (DOI-BLM-CO-110-2011-0058-EA). |

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| **Comment #/Comment Received From:** #140/AWHC |
| **Summarized Comment:** Nothing precludes the BLM from adjusting livestock grazing levels to accommodate the current wild horse population inside the PEDHMA. The final EA should fully analyze this alternative, including the cost benefits of offering permittees compensation for reduced use or non-use of AUMs. |

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| **BLM Response:** Refer to 3.4 Alternatives considered but Not Analyzed in Detail in the EA for Remove Livestock within the PEDHMA and Appendix E.4. These management level decisions are outside of the scope of this EA. |

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| **Comment #/Comment Received From:** #141/AWHC |
| **Summarized Comment:** The EA must provide data to explain why a reduction of livestock grazing could not fulfill the same objectives outlined for the removal of horses. Adjusting grazing is a viable and cost-effective alternative that must not be dismissed. |
| **BLM Response:** Refer to 3.4 Alternatives considered but Not Analyzed in Detail in the EA for Remove Livestock within the PEDHMA and Appendix E.4. for the detailed reason. |

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| **Comment #/Comment Received From:** #142/AWHC |
| **Summarized Comment:** The EA fails to consider an alternative that would allow livestock grazing while compensating permittees for non-use in order to provide the agency time to address the necessary land use planning process to raise the AML for wild horses and giving wild horses a fairer share of AUMs in the PEDHMA. It is unreasonable – and frankly poor policy – for the BLM to continue to allocate AUMs for livestock use in HMAs while the BLM removes wild horses toward unreasonably low AMLs. The BLM must demonstrate (providing empirical data in the EA for the proposed action) that the removal of wild horses is necessary to maintain or achieve a thriving natural ecological balance. |
| **BLM Response:** Refer to 3.4 Alternatives considered but Not Analyzed in Detail in the EA for Remove Livestock within the PEDHMA and Appendix E.4. for the detailed reason. |

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| **Comment #/Comment Received From:** #143/AWHC |
| **Summarized Comment:** The BLM must further analyze an alternative to manage wild horses in the PEDHMA at least at the high AML of 235 horses rather than reducing it to the low AML of 135 horses when a comprehensive PZP program is used in this HMA. |
| **BLM Response:** Returning wild horses to high AML was considered but was not carried forward for detailed analysis. The reason that it was not carried forward for detailed analysis are contained in Appendix E.3. The reasons that it was dismissed is that the wild horse population would grow to exceed approved population levels and would thus not represent a thriving natural ecological balance within the PEDHMA. |

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| **Comment #/Comment Received From:** #144/AWHC |

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| **Summarized Comment:** The BLM must consider all information it has available about the need to keep horse herds at certain population levels in order to prevent adverse genetic harm to the population; including inbreeding. |
| **BLM Response:** See response to comment #122 and EA Section 5.3.1, which indicate that the horses of the PEDHMA are not genetically isolated or unique, and that they are part of a larger, genetically interacting metapopulation. The genetic diversity monitoring that BLM would continue to conduct in the course of gather activities provides information about observed heterozygosity and inbreeding coefficient. In the event that those values are unacceptable, the BLM can take management measures to improve genetic diversity, including introduction of additional fertile animals to the herd, as noted in the EA. |

| **Comment #/Comment Received From:** #145/AWHC |
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| **Summarized Comment:** The low AML is the legal minimum that the BLM is required to manage on the range in any particular HMA, and therefore the BLM must ensure that it at least meets this requirement in the PEDHMA. |
| **BLM Response:** BLM will continue to manage for an AML of 135-235 wild horses in the PEDHMA as identified in the approved RMP and identified in section 3.1 and 3.2 of the EA. |

| **Comment #/Comment Received From:** #146/AWHC |
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| **Summarized Comment:** The BLM must first proceed with a study of IUDs before it can proceed to potentially using this tool as a management option for wild mares. Thus, it is reasonably foreseeable that the agency will develop study protocols, partner with an accredited institution, and receive IACUC approval for an IUD study, perhaps in the PEDHMA. Thus, analysis of a reasonably foreseeable IUD study is necessary in the final EA to ensure that the management plan preserves humane wild horse management in the PEDHMA. |
| **BLM Response:** Please see responses to comments above. The BLM is not required to conduct a study of IUD effects as part of its management activities on the PED HMA. There is enough available literature on the historical use of IUDs in horses, including recent pasture studies on the safety and efficacy of the use of Y-shaped silicone IUDs, to make reasonable inferences about the effects of the method on treated mares (see Appendix G). IUD use in horses is not uncommon historically and is a widely acceptable veterinary method. As such, the humane-ness of the method is not in question. |

| **Comment #/Comment Received From:** #147/AWHC |
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| **Summarized Comment:** A clear potential future action is the reduction or elimination of livestock AUMs within the PEDHMA as these management directives are established, and as |

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| such the BLM must analyze actions such as how the AUMs currently designated to cattle could be transferred to wild horses. Thus, the BLM must analyze in the EA how these foreseeable future actions would affect the management of wild horses in this PEDHMA. |
| **BLM Response:** Continued livestock grazing is an approved use in the approved RMP and is outside the scope of this EA. A foreseeable future action is: "Reasonably foreseeable future actions are those for which there are existing decisions, funding, formal proposals, or which are highly probable, based on known opportunities or trends." (H-1790-1) At this time there in no foreseeable future action that includes the reduction or elimination of livestock AUMs in the PEDHMA. |

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| **Comment #/Comment Received From:** #148/AWHC |
| **Summarized Comment:** The BLM must analyze how the implementation of any future range improvements, such as the projects BLM implements with the Piceance Mustangs volunteers, could affect the management of wild horses in the PEDHMA. |
| **BLM Response:** Any future range improvements would have individual site specific NEPA to analyze impacts of that specific project on all of the various resources. |

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| **Comment #/Comment Received From:** #149/AWHC |
| **Summarized Comment:** The analysis must include a map that shows the boundaries, livestock allotments, horse distribution (census map), water sources and fencing. Thus, analysis of reasonably foreseeable range improvements is necessary in the final EA to ensure that the management plan preserves wild horse use in the PEDHMA. |
| **BLM Response:** Maps that are relevant to the analysis area are provided in Appendix A. Wild horse use in the PEDHMA would continue as identified in the RMP and described in the Proposed Action (Section 3.1) of the EA. See response for Comment #149 for future range projects. |

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| **Comment #/Comment Received From:** #150/AWHC |
| **Summarized Comment:** The EA simply tiers to the 2011 EA for livestock use in this HMA. Instead, the BLM must both divulge statistics for the past decade of livestock use and delve into an analysis of the impacts from wild horses as compared to the impacts from livestock. The BLM should present monitoring data – both before and after livestock turnout – in successive years and present in detail the evidence it is using to attribute range damage to wild horses. Further, the BLM must consider the cumulative impacts of livestock grazing in this PEDHMA by, for example, analyzing the effects of alternating intensive grazing with periodic resting of grazing pasture because impacts of livestock grazing can continue for years or generations and cannot be mitigated by periodic one-year resting of grazing pastures. The absence of this information renders the BLM's consideration of removing wild horses to low |

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| AML in this management plan inappropriate and incomplete. Instead, the agency must also consider a reduction in livestock use in the Final EA as well. |
| **BLM Response:** Refer to 3.4 in the EA regarding removal of livestock and in Appendix E at E.4. |

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| **Comment #/Comment Received From:** #151/AWHC |
| **Summarized Comment:** The EA should include all census data of the wild horse population for each of the past 10 years. |
| **BLM Response:** It is BLM's intention to use inventories to aid in any decision regarding the need to gather and remove wild horses. The BLM utilizes the best available data from which to base its decisions. The most recent aerial survey, along with projected population growth based on reasonable annual growth rates (20% per year), consistent with peer reviewed meta-analysis of published demographic studies (Ransom et al. 2016), leads to the estimated herd size noted in EA Table 1. The current Environmental Assessment (EA) provides a full range of BLM's anticipated impacts utilizing that data. |

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| **Comment #/Comment Received From:** #152/AWHC |
| **Summarized Comment:** Actual and updated census information for at least the past few years, if it exists, would provide an accurate population increase percentage for this HMA – a figure that undoubtedly influences the future management of the wild horses. |
| **BLM Response:** Please refer to Section 1.1.2 Appropriate Management Level Table 1. It shows the current estimated (minimum) population projected from the last census in 2016. |

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| **Comment #/Comment Received From:** #153/AWHC |
| **Summarized Comment:** The EA should include all rangeland health assessments and monitoring data for grazing allotments in the PEDHMA for the past 10 years. The BLM should clearly describe the data and how it can differentiate the separate impacts of livestock use versus wild horse use. |
| **BLM Response:** Refer to Appendices B and C for determination of excess. Refer to Appendices B, Review of Current Situation Memo to the Field Manager to inform the Field Manager of the current wild horse populations and land health status. Refer to Appendices C, Excess Determination Memo from the Field Manager to Acting Northwest District Manager which determines that the number of wild horses are in excess and there is over utilization of primary resources (forage and water) on public state and private lands within the PEDHMA. As a result, this is negatively impacting our ability to preserve and maintain a thriving natural ecological balance (TNEB) and multiple-use relationship in that area. refer to the updated Appendix E. E3. Alternatives Related to Population Size or Structure at Adjust the |

Appropriate Management Level and to Section 1.4 for background on land use planning decisions that led to the determination of AML.