

**2016 Black-Tailed Prairie Dog Inventory at the
Rocky Mountain Arsenal National Wildlife Refuge**

February 2017



The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people.



The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations.

CITATION

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(Cover Photo) Ray Fetherman, 2015

Introduction:

The black-tailed prairie dog (*Cynomys ludovicianus* or prairie dog) is an integral member of the short- and mixed-grass prairie ecosystem found on the Rocky Mountain Arsenal National Wildlife Refuge (Refuge). Prairie dogs alter their environment by excavating soil for elaborate underground tunnels and removing vegetation for forage and improved visibility. Their communal lifestyle forming large colonies creates habitat that can support other short-grass prairie species, such as burrowing owls and black-footed ferrets. Prairie dogs are essential to the health of the prairie ecosystem as they provide a prey base for many raptors and carnivores while improving the prairie nutrient value for other herbivores making prairie dogs.

The Refuge is located on a site that was substantially disturbed by human activity in the past. This disturbance resulted in, among other things, an ecosystem with an abundant population of prairie dogs. This high number of vegetative consumers is in conflict with the larger goal of grassland restoration. Restoration of short- and mixed-grass prairie is of primary importance at the Refuge (FWS 2013a). Furthermore, high densities of prairie dogs are unhealthy for the colonies themselves. An epizootic event such as sylvatic plague spreading through the colony can be catastrophic resulting in high rates of death. In order to promote prairie restoration and ecological balance the Refuge has designated 2,995 acres, or 18.5% of the Refuge as prairie dog habitat and for management purposes have been divided into geographical zones (FWS 2013a, FWS 2013b). These zones were instituted to provide adequate prairie dog occupied areas while supporting grassland restoration efforts. Three management zones are located on the Refuge and are known as the Southwest, Eastern, and Northwest Prairie Dog Management Zones (see map). The Southwest Zone is comprised of parts of Sections 2 and 3. The Eastern Zone contains parts of Sections, 5,8,19,20,29,30, and 32. The Northwest Zone is comprised of parts of Sections 22, 27, and 28. The target density of 6-10 prairie dogs per acre in these zones is desired to prevent the overutilization of vegetation and promote the health of the prairie dog population (FWS 2013b). To determine prairie dog densities in the management zones, an inventory of black-tailed prairie dogs was initiated in 2014. The objectives of the inventory were to establish baseline densities of prairie dogs on the Refuge and to ensure sufficient prairie dog densities to support the reintroduction of black-footed ferrets (*Mustela nigripes*). Inventories will be conducted yearly or as needed to understand prairie dog densities, spatial distribution of the prairie dog complex, and the health of the prairie dog population on the Refuge. The data collected will be used to track changes or find trends in the prairie dog population that may lead to future management actions.

The black-footed ferret is among the most endangered species in North America where there has been a collective and robust effort to try to recover the species (FWS 2014c). Recovery of this species is a high priority for the Mountain Prairie Region of US Fish and Wildlife Service for 2016 and is expected to remain a priority for years to come (FWS 2013c, FWS 2014b). After a decade of captive breeding, several self-sustaining population are needed to ensure the recovery of the species. The reintroduction of black-footed ferrets onto Rocky Mountain Arsenal National

Wildlife Refuge is an effort to establish a self-sustaining population on that site. For the reintroduction efforts at the Refuge to be considered a success, the population will have to sustain itself for 3 years (FWS 2014c). A major factor of ensuring sustainability of the ferrets at the Refuge is a reliable food source consisting, predominately, of black-tailed prairie dogs. The prairie dogs inventories will help to ensure a sufficient density of prairie dogs to support a population of black-footed ferrets on the Refuge.

Purpose:

The purpose of this inventory is to determine black-tailed prairie dog distribution, densities, and population size within the management zones at the Rocky Mountain Arsenal National Wildlife Refuge as adopted in the Refuge's Habitat Management Plan (HMP) 2010 (FWS 2013a). The results of the inventory will guide future management decisions for the prairie dog populations in support of habitat restoration and black-footed ferret recovery.

Methods:

Survey methods and data analysis were based on protocol established by Biggins et al. (1993, 2006) and consistent with prior surveys at the Refuge (FWS 2014 and 2015). Surveys should be conducted from mid-June through August after prairie dog pups have emerged (Biggins et al. 1993). In the past, 5% of the management zones were surveyed and data was extrapolated to estimate prairie dog densities (Biggins et al, 1993). It was determined by the Region 6 Inventory and Monitoring Program that surveying half of that area would yield the necessary information to estimate densities with a confidence interval of $\geq 95\%$ (Orien Richmond, personal communication, Spring 2016). In 2016 we surveyed three-meter wide transects spaced 120 meters apart with a north-south orientation within the boundaries of the management zones. If a management zone contained multiple sections, each section was surveyed individually. Transects start approximately 10 feet from the section boundary and end either at the boundary of the management zone or within 10 feet of the next section boundary. Transects were created as a shapefile in ArcGIS 10.2 and transferred to a Trimble GeoXT GPS unit using TerraSync software. To visualize the 3-meter width of each transect, a 3-meter long aluminum pipe was attached at the midpoint of a backpack frame and chains were hung perpendicular to the ground by bolts 3-meters apart on the pipe (Figure 1).

Transects were surveyed by groups of two individuals. One person carried the GPS unit with the pre-loaded transects and wore the backpack with the 3-meter pole. That person navigated the transect using GPS while the 2nd person followed the backpacker. The second person was far enough behind to be able to see both ends of the 3-meter pole. That person then recorded on a data sheet the number of active and inactive prairie dog burrows that fell within the 3-meter width of the pole along the entire length of the transect (Figure 2, Table 1). If $>50\%$ of a burrow was within the 3-meter pole as gaged by the hanging chains, the burrow was counted. The team started on one side of the management zone and walked along the north/south transects

progressing toward the other side of the management zone. If there are two survey teams, transects were split into odd and even numbers or each team started at a side and worked toward the middle.



Figure 1. 3-Meter Survey Backpack



Figure 2. Transect survey team

The following criteria were used to identify a burrow as active or inactive:

- Burrows were considered active if the opening was at least 7 cm and the end was not visible (Figure 3). Active burrows also included those with fresh scat or vegetation clippings within 0.5 m of the burrow. Burrows with spider webs or fresh debris in the entrance would not be disregarded as active as long as there was fresh scat within 0.5 m. Fresh scat is described as not dried hard and green, black, or dark brown in color. Large, badger-reamed burrows are counted because prairie dogs are known to use the burrow after the badger vacates them (Biggins et al 1993).
- Burrows were considered inactive if they were covered with vegetation, debris, spider webs, or were noticeably unused (Figure 4).
- Digging on the surface that did not result in a hole was disregarded.



Figure 3. Active burrow



Figure 4. Inactive burrow

Results:

Black-tailed prairie dog densities

Approximately 100 kilometers of 3-meter wide transects were surveyed over 12 days beginning July 26 and ending August 19, 2016. The area of the transects surveyed totaled 297342.5 m² or 73.5 acres, approximating 2.5% of the 2,995 acres managed as prairie dog habitat at the Refuge.

The following formula derived by Dean Biggins and colleagues (1993) was used to determine the densities of prairie dogs (PD) per hectare for each transect.

$$\text{Prairie Dog Density (PD/ha)} = [(\# \text{ of active burrows} * 0.179 / 0.566) / (\text{transect length} * 3)] * 10,000$$

In this equation, 0.179 is the regression coefficient between the number of active burrows counted and the number of prairie dogs; and, 0.566 is the observability index for black-tailed prairie dogs.

The densities were then converted from prairie dogs/ hectare to prairie dogs/acre and the mean densities were derived for each management zone (Table 2) then broken down into individual sections within the management zones (Table 3).

The mean prairie dog density of the management zones was 17.5 PD/acre. Management zone densities ranged from 16.7 PD/acre in the Eastern Zone to 20.7 PD/acre in the Southwest Zone. Each of the management zones exceeded the desired population density of 6-10 PD/ac (Table 2).

Section 20 had the lowest density with 12.4 PD/acre and Section 2 had the highest with 27.8 PD/acre. Each of the sections exceeded the desired population density of 6-10 PD/acre. Within the Southwest Zone, Section 2 had the highest density while Section 3 had a density of 17.4 PD/acre which is below the median value of 19.0 PD/acre. The lowest density within the Eastern Zone was 12.4 PD/acre in Section 20 and the highest was 26.48 PD/acre in Section 8. The lowest density within the Northwest Zone was 18.3 PD/acre in Section 27 while the highest density was in Section 22 at 22.7 PD/acre.

Densities were then compared across management zones (Graph 1) and sections (Table 4, Graph 2) over the 3 year period the surveys have been conducted at the Refuge. Densities were lowest in the Southwest Zone in 2014 and 2015, but lowest in the Eastern Zone in 2016. Densities were highest in the Northwest Zone in 2014 and 2015, but highest in the Southwest Zone in 2016. Overall densities stayed higher in the Northwest Zone over the 3 years. Section 5 had the lowest densities in 2014 and 2015, while Section 20 had the lowest density in 2016. Section 8 had the highest prairie dog densities per acre each of the 3 years surveyed. Densities were seemingly more consistent over the 3 year period in the Northwest Zone. There was a lot of variability in densities of the sections that make up the other 2 management zones. The overall mean prairie dog density

for the Southwest Zone from 2014-2016 was 18.0 PD/acre. The overall mean prairie dog density for the Eastern Zone from 2014-2016 was 19.0 PD/acre. The overall mean prairie dog density for the Northwest Zone from 2014-2016 was 20.1 PD/acre. The overall variability across management zones from 2014-2016 does not exceed 2.1 PD/acre. The mean density for the Southwest Zone in 2014 was 16.7 PD/acre, 14.6 PD/acre in 2015, and 22.6 PD/acre in 2016. The Southwest Zone density spiked in 2016 with an increase of 35.4% from 2015 to 2016. This was largely due to a 51.9% increase in prairie dog density in Section 2 from 2015 to 2016. The mean density for the Eastern Zone in 2014 was 18.3 PD/acre, 20.0 PD/acre in 2015, and 18.8 PD/acre in 2016. The overall variability across the years did not exceed 1.7 PD/acre. The mean density for the Northwest Zone in 2014 was 19.2 PD/acre, 19.9 PD/acre in 2015, and 21.2 PD/acre in 2016. This shows an overall positive trend across the years that does not exceed 2.0 PD/acre.

Prairie dog densities to support Black-footed ferret families

The average number of prairie dogs a year needed to sustain a black-footed ferret family is 763. A ferret family consists of 1 female, 3.3 young, and 0.5 males (Biggins et al. 1993). A good habitat for the release of black-footed ferrets is one with more than 12 PD/ha (4.85 PD/ac) (Biggins et al. 1993). In order to determine if the prairie dog habitat management zones are suitable habitat for the reintroduction of the black-footed ferret, we incorporated the transect data into a spreadsheet provided by Dr. Dean Biggins of U.S. Geological Society. Originally there was an energetic model with a linear conversion from the number of prairie dogs to the number of black-footed ferret families (PD/763), which is to say 763 prairie dogs can support one ferret family per year and a rating is assigned (Biggins et al. 1993). This was edited in later years to incorporate the territoriality of the ferrets after you reach 18 PD/ha and suggest that once prairie dog populations exceed 42 PD/ha, ferret populations do not increase (Biggins et al. 2006). The Southwest Zone at the Refuge has a rating of 0.93, the Eastern Zone has a rating of 36.51 and the Northwest Zone has a rating of 9.93 (Table 5). In total the Refuge can support 47 ferret families inside the prairie dog management zones.

Discussion:

Acreage on the Refuge managed for prairie dog habitat as well as acreage within the management zones has shifted over time. Total acreage managed for prairie dog habitat on the Refuge in 2015 totaled 2,580.4 acres. In 2016 the total acreage managed for prairie dog habitat was 2,995.0 acres. That is an increase in managed prairie dog habitat of 21.0% from 2015 to 2016. Managed habitat in the Eastern Zone went from 1,753.3 in 2015 to 2,364.6 acres in 2016. This was an increase of 611.3 acres, or a 25.9% increase in this zone. In the Northwest Zone, 65.2 acres were removed from Section 23, habitat increased by 57.1 acres in Section 22 and 28.7 acres in Section 27. In total managed habitat in the Northwest Zone increased by 21.2 acres, or 3.6%, in 2016. In past years there was a Southern Management Zone on the Refuge comprised of parts of Sections 7, 11 and 12. Acreage in the zone was 217.7 acres but it is no longer being managed as prairie dog habitat. Managed habitat in the Southwest Zone did not change from 2015 to 2016.

These changes in acreage could have affected calculated prairie dog densities, accounting for some of the variability between 2016 and previous years.

Reoccurring inventories of the black-tailed prairie dogs on RMANWR are essential to the Comprehensive Conservation Plan/HMP objectives to maintain a healthy prairie dog population, allow for habitat restoration to occur, and to reintroduce black-footed ferrets onto the refuge.

Results from the 2016 inventory indicate that prairie dog densities on the refuge are more than adequate to support existing populations of reintroduced black-footed ferrets and any future offspring. In October 2015, 32 ferrets were released in the Eastern Zone, followed by an additional 22 in September 2016. A population survey of the ferrets in September 2016 found a survival rate of about 50% of released ferrets and 15 wild-born kits, showing the population is thriving and reproducing (FWS 2016). The prairie dog population in this management zone has not been dramatically affected by the releases, showing that the stable density of prairie dogs can sustain the ferrets currently inhabiting the Eastern Zone. The Northwest Zone also shows promise in supporting a black-footed ferret release, with 20.21 PD/acre. The Eastern Zone covers an area of 2,364 acres while the Northwest Zone only includes 589 acres which may prove to limit the ferret population if released in this area. Female black-footed ferrets can maintain a home range up to 7 miles, but usually inhabit a smaller area when they have young (Biggins et al. 1993).

The density of prairie dogs is much larger than the goal of 6-10 PD/acre needed to allow native vegetation to establish on the refuge. Over time the black-footed ferrets released onto the refuge and their progeny could prove to naturally balance the prairie dog population. However, given the time it may take for this to evolve some management of the prairie dog population by refuge staff may be necessary. During 2014 and 2015, a contractor was hired to protect prairie dogs within the zones from plague by dusting with Deltamethrin and removing prairie dogs from all outlying colonies. The contracted work continued in 2016 and was supplemented by Refuge staff. In 2016, approximately 1,100 acres of prairie dog colonies in the Eastern Zone were treated with experimental sylvatic plague vaccine baits to further protect the population from a plague event. These manipulations could potentially have augmented the population densities inside the zones by 1) increasing survivorship and reproduction inside the zone and 2) causing rogue prairie dogs outside the zones to disperse to zone edges rather than exist in isolated, unpopulated areas. This could affect both habitat restoration projects as well as the range of the black-footed ferrets on the refuge.

The inventories collected in 2014 and 2015 will be used as a baseline for the prairie dog population on RMANWR, while the 2016 inventory will be used to understand trends in the population. This will also allow for the evaluation of different management techniques. The inventory can be used to monitor for an outbreak of plague or other major population fluctuations as well. Comparing the number of active to inactive burrows can be an indication of a plague event if more than 50% of the total burrows are inactive (Biggins et al. 1993).

Initial trend analyses shows there is no clear pattern for densities across the management zones over the 3 year period. The Eastern and Northwest Zones appear to have less variability in density from year to year than does the Southwest Zone. The mean density variability within the management zones shows similar results to the above in that there is less variability in densities in the Eastern and Northwest Zones than in the Southwest Zone.

Two study design changes occurred in 2016: 1) the modification of boundaries and acreage in the zones and 2) The reduction of transect numbers by half.

Two suggestions to improve the efficacy of the inventories to be considered: 1) Mow the management zones prior to walking the transects to remove the tall vegetation. This would help with manipulating the 3 meter wide pole as well as increase visibility of the burrows under the dense foliage (Figure 5). 2) Allow the use of ATVs to reduce the time needed to conduct the surveys. This technique was explored at the Refuge in 2016 (Appendix A), but not adopted as standard.



Figure 5. Transect in high vegetation

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Tables and Graphs:

Table 1. Prairie dog density data sheet.

Black-Tailed Prairie Dog Burrow Density and Activity in Prairie Dog Management Zones on RMANWR					
Section/Location:				Date:	Page of
Observer(s)					
Transect #	Distance	# of Burrows			Comments
		Active	Inactive	Total	

Table 2. Black-tailed Prairie Dog (PD) Densities by Management Zones at Rocky Mountain Arsenal National Wildlife Refuge in 2016.

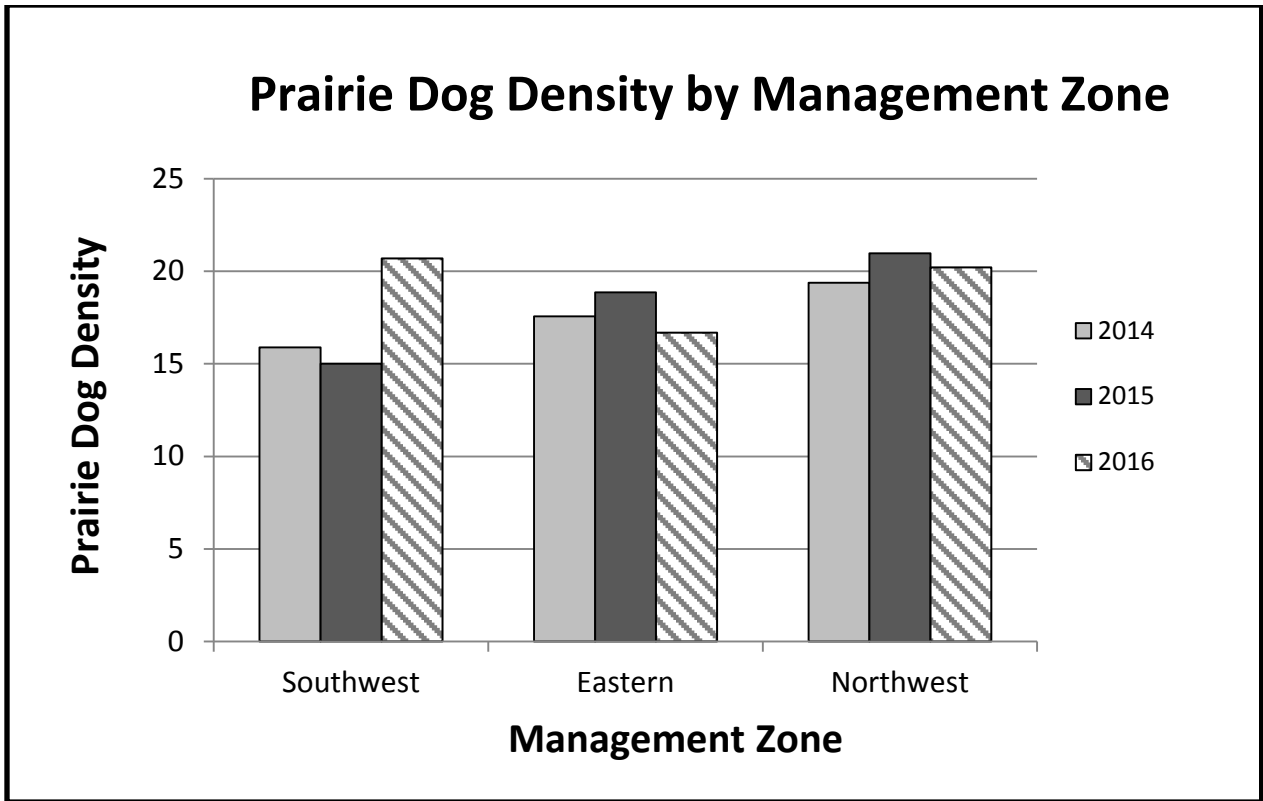
Management Zone	Area of Transects (m ²)	PD Count	PD/hectare	PD/acre
Southwest (SWZ)	8,231	42	51.10	20.69
Eastern (EZ)	232,155	957	41.21	16.68
Northwest (NWZ)	56,956	284	49.92	20.21
Total (or mean)	297,343	1,283	(43.15)	(17.47)

Table 3. Black-tailed Prairie Dog (PD) Densities by Public Land Survey System Sections at Rocky Mountain Arsenal National Wildlife Refuge in 2016.

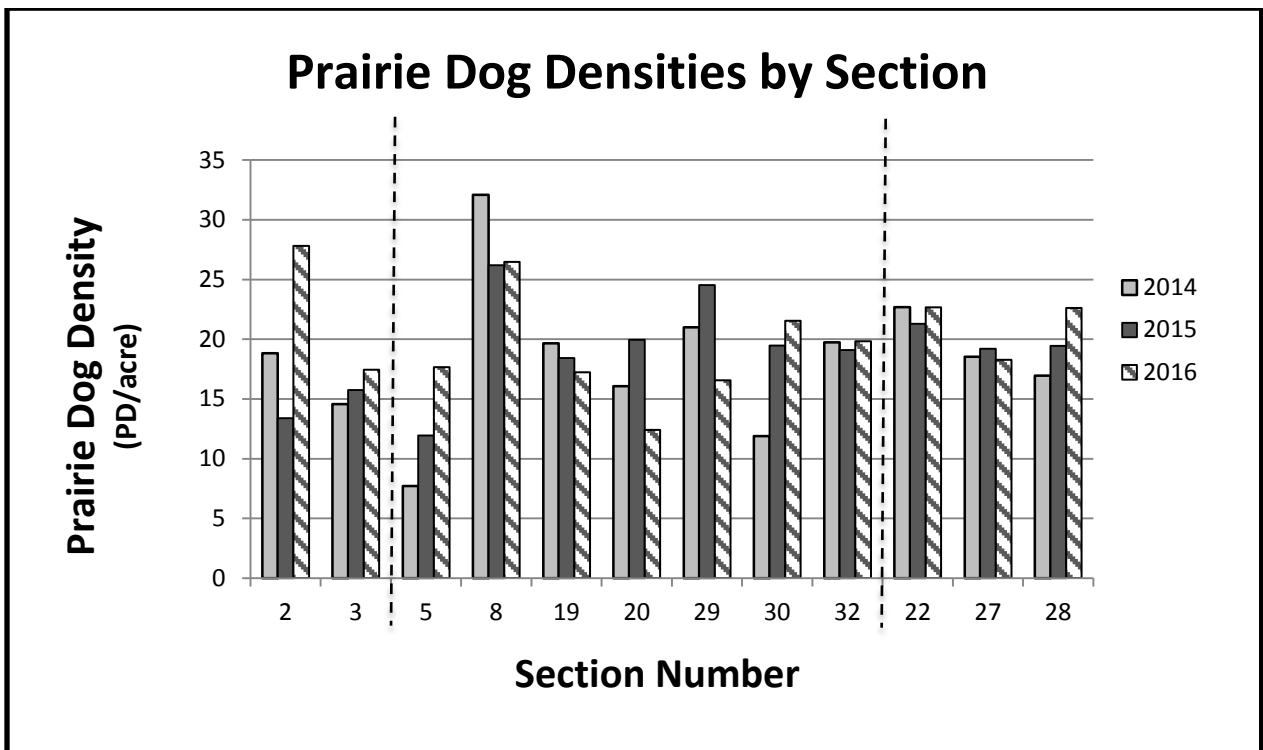
Section	Area of Transects (m ²)	PD Count	PD/hectare	PD/acre
2 (SWZ)	2,578	18	68.70	27.81
3 (SWZ)	5,653	24	43.08	17.44
5 (EZ)	26,100	114	43.62	17.66
8 (EZ)	2,515	16	65.40	26.48
19 (EZ)	32,730	139	42.51	17.21
20 (EZ)	58,245	178	30.62	12.40
29 (EZ)	62,374	255	40.87	16.55
30 (EZ)	19,384	103	53.19	21.53
32 (EZ)	30,807	151	48.97	19.82
22 (NWZ)	23,513	132	55.95	22.65
27 (NWZ)	31,631	143	45.09	18.26
28 (NWZ)	1,813	10	55.83	22.60
Total (or mean)	297,343	1,283	(43.15)	(17.47)

Table 4. Comparison of Black-tailed Prairie Dog Densities at Rocky Mountain Arsenal National Wildlife Refuge from 2014 to 2016 arranged by Public Land Survey System Sections.

Section	2014 PD/acre	2015 PD/acre	2016 PD/acre
2 (SWZ)	18.83	13.38	27.81
3 (SWZ)	14.56	15.75	17.44
5 (EZ)	7.70	11.95	17.66
8 (EZ)	32.10	26.21	26.48
19 (EZ)	19.67	18.44	17.21
20 (EZ)	16.08	19.96	12.40
29 (EZ)	21.00	24.55	16.55
30 (EZ)	11.89	19.47	21.53
32 (EZ)	19.73	19.09	19.82
22 (NWZ)	22.70	21.3	22.65
27 (NWZ)	18.54	19.2	18.26
28 (NWZ)	16.95	19.44	22.60



Graph 1. Comparison of Black-tailed Prairie Dog Densities by Year and Management Zone at Rocky Mountain Arsenal National Wildlife Refuge.



Graph 2. Comparison of Black-tailed Prairie Dog Densities by Year and Public Land Survey System Section at Rocky Mountain Arsenal National Wildlife Refuge.

Table 5. Number of Black-footed Ferret Families (1 female, 3.3 young, and 0.5 male (Biggins et al. 1993)), calculated 4 ways, the Rocky Mountain Arsenal National Wildlife Refuge Can Support as of Summer 2016 arranged by Management Zones.

Management Zone	Rating 1993 (PD/763)	>18 PDs	≥42 PDs	Rating 2006 if 1993 Rating <2
Southwest	0.93	0.50	0.55	0.93
Eastern	50.32	36.29	36.51	36.51
Northwest	15.68	9.38	9.54	9.93
Total	66.93	46.17	46.60	47.37

Table 6. The Number of Black-footed Ferret Families (1 female, 3.3 young, and 0.5 male (Biggins et al. 1993) the Rocky Mountain Arsenal National Wildlife Refuge Can Support as of Summer 2016 arranged by Public Land Survey System Sections.

Sec	N	PROP GOOD	HA	HA GOOD	BUR /HA	PD /HA	PD EST	PD /763	>18 PDs	≥42 PDs	2006
2 (SWZ)	6	0.8	5.3	4.4	217.2	68.7	303.3	0.40	0.13	0.18	0.4
3 (SWZ)	10	0.8	11.7	9.4	136.2	43.1	403.2	0.53	0.37	0.37	0.5
5 (EZ)	9	1.0	107.4	107.4	137.9	43.6	4684.9	6.14	4.31	4.30	4.3
8 (EZ)	2	1.0	10.4	10.4	206.8	65.4	680.1	0.89	0.34	0.42	0.89
19 (EZ)	11	0.9	128.8	117.1	134.4	42.5	4977.5	6.52	4.68	4.68	4.7
20 (EZ)	13	0.9	240.4	221.9	96.8	30.6	6794.9	8.91	7.79	7.79	7.8
29 (EZ)	13	1.0	256.8	256.8	129.2	40.9	10494.5	13.75	10.2	10.2	10.2
30 (EZ)	12	1.0	77.4	77.4	168.2	53.2	4116.7	5.40	3.04	3.10	3.1
32 (EZ)	13	1.0	135.7	135.7	154.8	49.0	6645.1	8.71	5.45	5.43	5.4
22 (NWZ)	11	1.0	100.1	100.1	176.9	56.0	5601.1	7.34	3.84	4.00	4.0
27 (NWZ)	14	1.0	126.5	126.5	142.6	45.1	5704.1	7.48	5.09	5.06	5.1
28 (NWZ)	3	1.0	11.8	11.8	176.5	55.8	658.8	0.86	0.45	0.47	0.9
Total (mean)	117	(1.0)	1212.3	1178.8	156.5	49.5	51064.2	66.93	45.7	45.9	47.2

Sec=Section number

N=Number of transects

PROP GOOD =Proportion of good habitat (transects with > 12 prairie dogs per hectare)

HA=Hectares of prairie dog habitat within the management zone for each section

HA GOOD=Hectares of good prairie dog habitat in each section (PROP GOOD * HA)

BUR/HA=Active burrows per hectare of good prairie dog habitat

PD/HA= Prairie dogs per hectare (=BUR/HA*0.179/0.566)

PD EST=Estimated prairie dogs in each section (PD/HA * HA GOOD)

PD/763=Linear conversion of PDs to BFFs (PD EST/763, Biggins et al. 1993)

>18 PDs=This conversion of PDs to BFFs incorporates an increasing effect of BFF territoriality when PD density > 18/ha (Biggins et al. 2006)

≥42 PDs=This conversion shows no increase in BFFs if PD density ≥42 PDs/ha

2006=This conversion presumes lack of competition if the potential for the Section is to support less than 2 BFF families. It defaults to the PD/763 value (Biggins et al. 2006)

Appendix A- Raw Data Tables:

Section 3					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
3_3_102	510593 510593	4407109 4407040	68.9	9	1
3_3_103	510653 510653	4407197 4406993	195.4	7	2
3_3_104	510713 510713	4407288 4406993	294.3	8	3
3_3_105	510773 510773	4407246 4406994	242.5	16	4
3_3_106	510833 510833	4407081 4406995	86.0	1	1
5_3_113	510631 510631	4407186 4407470	280.5	17	2
5_3_114	510571 510571	4407098 4407473	374.5	15	3
5_3_115	510511 510511	4407251 4407475	224.0	4	2
5_3_116	510451 510451	4407405 4407478	72.4	0	0
5_3_117	510391 510391	4407432 4407477	45.8	0	0
Total			1884.4	77.00	18.00

Section 2					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
4_2_107	511619 511619	4407398 4407309	88.0	0	0
4_2_108	511679 511679	4407395 4407225	170.1	18	1
4_2_109	511739 511739	4407361 4407179	181.4	20	0
4_2_110	511799 511799	4407254 4407112	141.3	3	0
4_2_111	511859 511859	4407244 4407100	144.3	7	2
4_2_112	511919 511919	4407242 4407107	134.3	8	0
Total			859.3	56.00	3.00

Section 2- Re-Count on ATV					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
4_2_107	511619 511619	4407398 4407309	88.2	1	0
4_2_108	511679 511679	4407395 4407225	168.3	14	0
4_2_109	511739 511739	4407361 4407179	182.1	16	1
4_2_110	511799 511799	4407254 4407112	143.1	10	0
4_2_111	511859 511859	4407244 4407100	145.1	8	2
4_2_112	511919 511919	4407242 4407107	133.1	12	0
Total			859.9	61.00	3.00

Section 5					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
1_05_63			1537.2	83	2
1_05_64			1588.8	53	1
1_05_65			1348.8	56	3
1_05_66			1011.6	30	2
1_05_67			843.7	34	1
1_05_68			783.9	44	3
1_05_69			792.1	37	1
1_05_70			630.7	19	2
1_05_71			163.3	4	1
Total			8700.1	360.00	16.00

Section 8					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
1_08_72			403.4	17	1
1_08_73			434.8	35	1
Total			838.2	52.00	2.00

Section 19					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
1_19_01			153.2	1	6
1_19_02			342.3	13	1
1_19_03			1036.6	42	7
1_19_04			1081.4	38	8
1_19_05			1146.2	37	4
1_19_06			1153.1	41	11
1_19_07			1172.6	43	10
1_19_08			1182.6	53	15
1_19_09			1227.5	60	21
1_19_10			1208.9	50	17
1_19_11			1205.9	62	19
Total:			10910.2	440	119

Section 20					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
1_20_12			1527.7	34	24
1_20_13			1527.1	45	20
1_20_14			1528.0	42	29
1_20_15			1527.7	41	27
1_20_16			1527.7	74	12
1_20_17			1532.8	51	12
1_20_18			1535.7	38	39
1_20_19			1534.2	30	39
1_20_20			1533.6	57	5
1_20_21			1528.3	60	9
1_20_22			1507.6	7	7
1_20_23			1358.3	37	16
1_20_24			1246.5	48	7
Total:			19415.1	564	246

Section 29					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
1_29_25			1601.6	58	7
1_29_26			1600.2	59	5
1_29_27			1600.9	29	4
1_29_28			1601.3	34	0
1_29_29			1598.5	90	13
1_29_30			1603.3	75	11
1_29_31			1601.4	88	9
1_29_32			1598.2	70	7
1_29_33			1598.4	74	11
1_29_34			1594.9	41	7
1_29_35			1601.0	73	8
1_29_36			1595.0	60	8
1_29_37			1596.7	55	11
Total:			20791.4	806	101

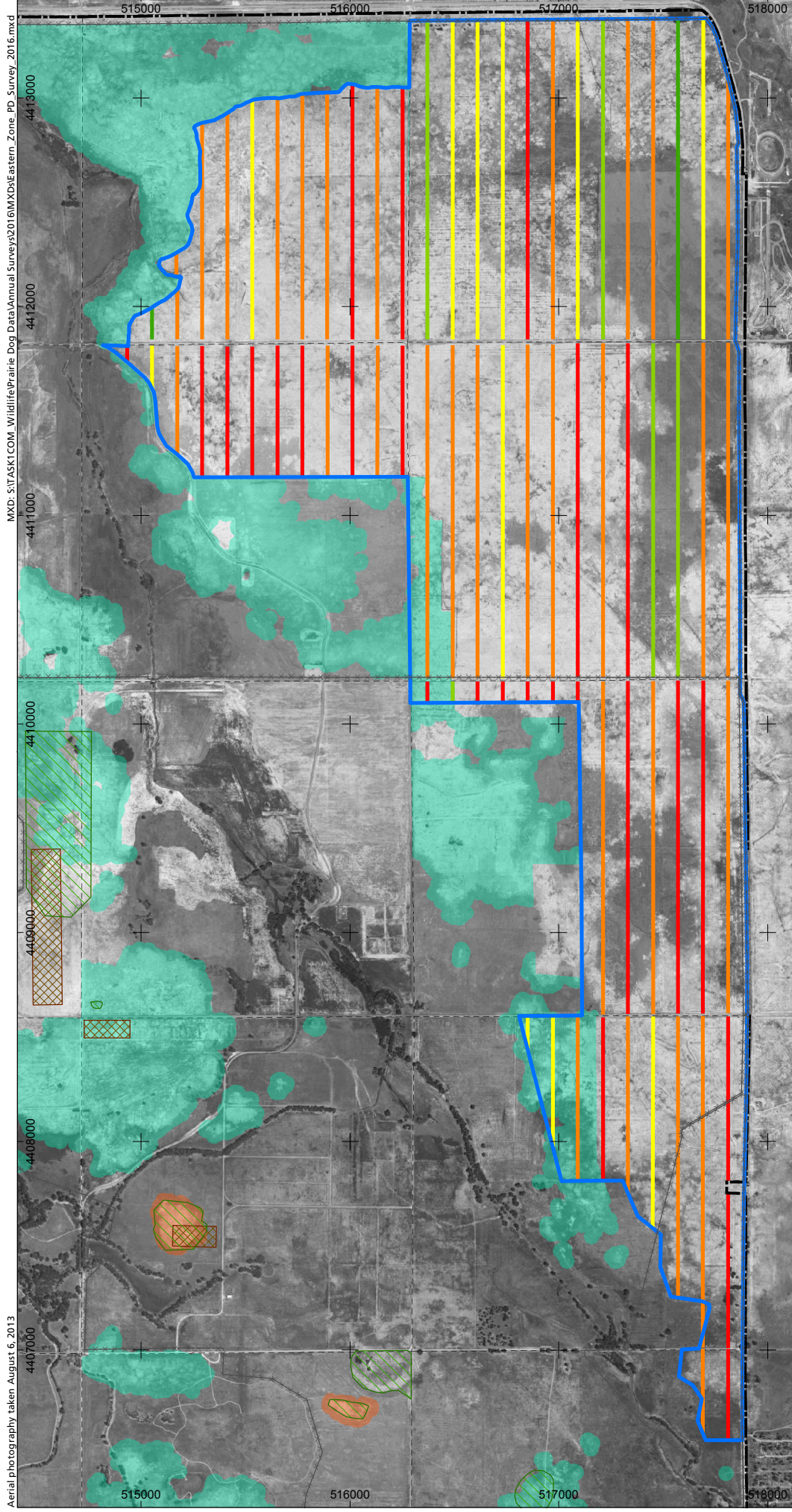
Section 30					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
1_30_38			630.2	43	4
1_30_39			628.3	26	4
1_30_40			629.4	31	7
1_30_41			629.4	26	1
1_30_42			628.1	32	6
1_30_43			628.4	41	5
1_30_44			624.1	30	4
1_30_45			628.4	31	2
1_30_46			628.8	30	5
1_30_47			521.7	23	4
1_30_48			207.6	6	0
1_30_49			76.9	7	0
Total:			6461.2	326	42

Section 32					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
1_32_50			100.0	5	1
1_32_51			100.2	2	0
1_32_52			99.5	6	2
1_32_53			99.0	8	0
1_32_54			97.5	5	0
1_32_55			97.7	7	0
1_32_56			99.1	5	0
1_32_57			1597.9	56	11
1_32_58			1595.7	86	7
1_32_59			1596.2	69	24
1_32_60			1596.1	76	21
1_32_61			1595.3	84	11
1_32_62			1594.8	68	6
Total			10269.0	477.00	83.00

Section 22					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
2_22_74			1363.4	78	13
2_22_75			1242.0	61	6
2_22_76			1115.2	63	2
2_22_77			898.7	42	6
2_22_78			845.6	45	5
2_22_79			652.0	29	1
2_22_80			620.1	31	4
2_22_81			471.6	28	3
2_22_82			337.4	21	1
2_22_83			209.9	11	0
2_22_84			81.7	7	0
Total			7837.5	416.00	41.00

Section 27					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
2_27_88			456.5	21	0
2_27_89			574.5	29	3
2_27_90			654.8	20	1
2_27_91			803.9	34	6
2_27_92			805.9	35	2
2_27_93			803.7	44	0
2_27_94			807.4	35	3
2_27_95			804.5	36	7
2_27_96			807.0	33	7
2_27_97			804.6	32	7
2_27_98			805.6	32	3
2_27_99			806.4	36	1
2_27_100			806.5	31	17
2_27_101			802.5	33	14
Total			10543.7	451.00	71.00

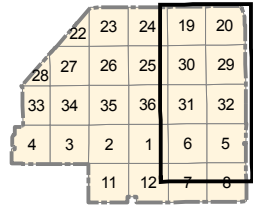
Section 28					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
2_28_85			61.9	2	0
2_28_86			200.1	12	0
2_28_87			342.2	18	3
Total			604.2	32.00	3.00



MXD: S:\TASKS\COM_Wildlife\Prairie Dog Data\Annual Surveys\3016\MXD\DE\Eastern_Zone_PD_Survey_2016.mxd

Aerial photography taken August 6, 2013

U.S. Fish & Wildlife Service
Rocky Mountain Arsenal
National Wildlife Refuge
Black-Tailed Prairie Dog
Management Program
Eastern Zone

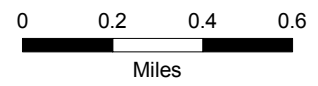


- Wildlife Fence
- Prairie Dog Mgmt Zones (2585 Acres)
- Refuge Boundary
- Section Line

- Prairie Dogs per Acre**
- 0 to 6
 - > 6 to 10
 - > 10 to 14
 - > 14 to 20
 - > 20 to 56 (Maximum)

APHIS Department of Agriculture - APHIS
 (Animal and Plant Health Inspection Service)
 Prairie Dog Management Action

- FY2014 APHIS Treatment (2761 Acres)
- FY2015 APHIS Treatment (1504 Acres)
- FY 2016 APHIS Treatment Areas
- FY 2016 USFWS Treatment Areas



Transverse Mercator Projection
 UTM Zone 13 North, Units Meters
 North American Datum 1983
 Data Sources: USFWS, USDA



U.S. Fish & Wildlife Service

Rocky Mountain Arsenal National Wildlife Refuge Black-Tailed Prairie Dog Management Program Northwest Zone

	22	23	24	19	20
26	27	28	25	30	29
33	34	35	36	31	32
4	3	2	1	6	5
	11	12	7	8	

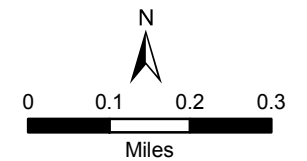
- Wildlife Fence
- Section Lines
- ▭ Refuge Boundary
- ▭ Prairie Dog Mgmt Zones (2585 Acres)

Prairie Dogs per Acre

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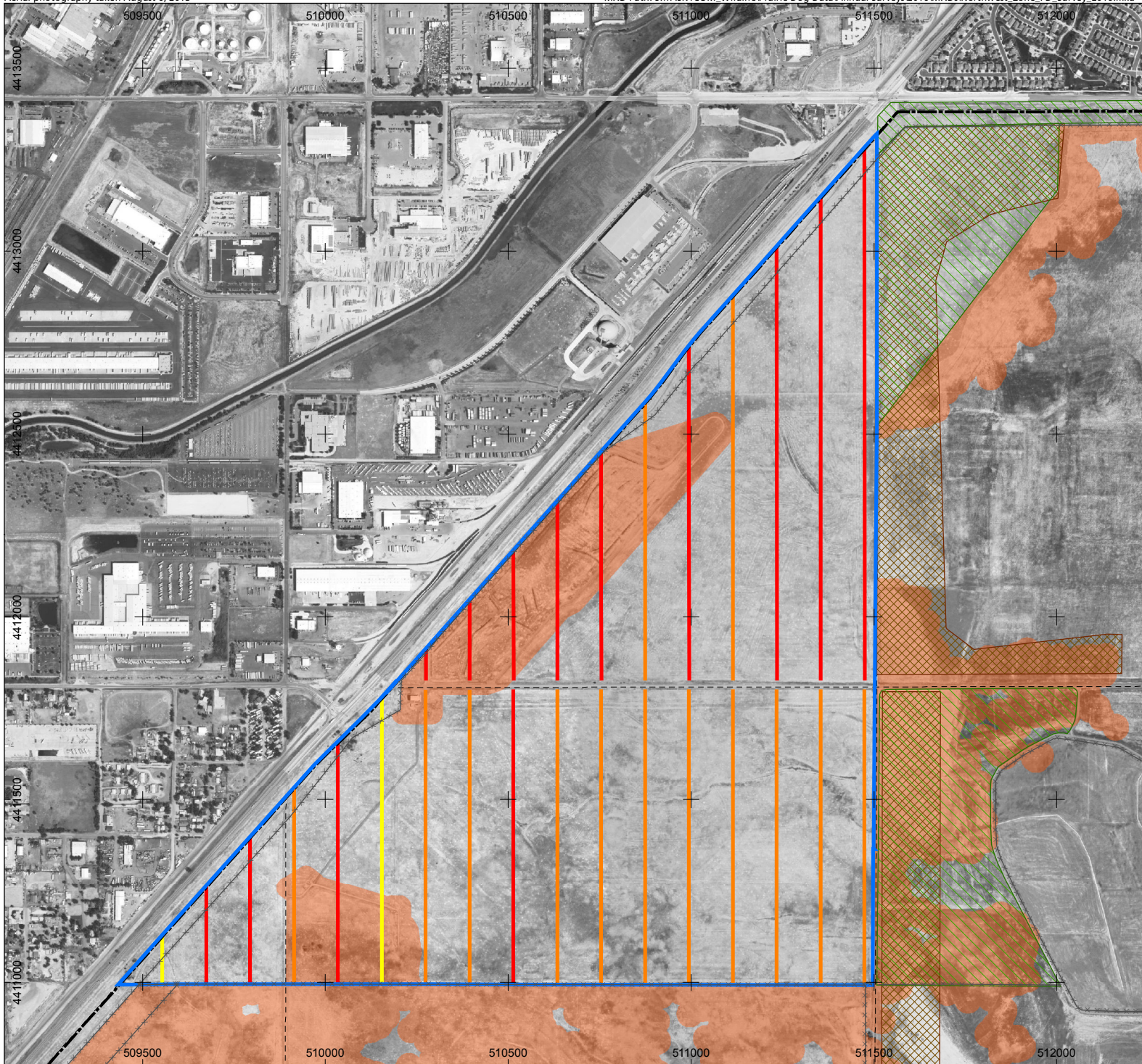
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Transverse Mercator Projection
UTM Zone 13 North, Units Meters
North American Datum 1983
Data Sources: USFWS, USDA

2016 Black-Tailed Prairie Dog Density and Activity Survey



U.S. Fish & Wildlife Service

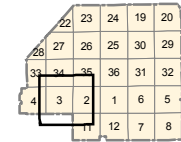
Rocky Mountain Arsenal

National Wildlife Refuge

Black-Tailed Prairie Dog

Management Program

Southwest Zones



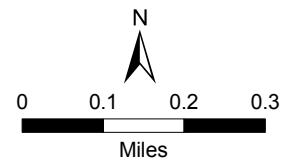
- Wildlife Fence
- Section Lines
- ▭ Refuge Boundary
- ▭ Prairie Dog Mgmt Zones (2585 Acres)

Prairie Dogs per Acre

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Transverse Mercator Projection
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2016
Black-Tailed Prairie Dog
Density and Activity Survey

