U.S. Fish & Wildlife Service

2014 Black-Tailed Prairie Dog Inventory at the Rocky Mountain Arsenal National Wildlife Refuge

February 2015

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.

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(Cover Photo) Dave Showalter. 2013

Introduction

The Rocky Mountain Arsenal National Wildlife Refuge (RMANWR) has designated 2,585 acres of habitat as prairie dog management zones in order to promote successful native prairie restoration and ecological balance (FWS 2013a, FWS 2013b). Following native prairie restoration within designated zones, managing the density of prairie dogs of 6-10 animals/acre is desired to prevent overutilization of vegetation, ensuring the critical long-term sustainability of native vegetation. However, a sufficient density of animals should also be maintained to ensure that adequate habitat and sufficient prey base is available for resources of concern.

Restoration of short- and mixed-grass prairie are considered to be of primary importance in achieving the purpose of RMANWR because these habitat provide the life requisites of numerous migratory bird species, many of which are considered to be species of conservation concern due to population declines. The large disturbance that occurred on the site has created conditions leading to high prairie dog populations, which is in conflict with larger goals for grassland restoration.

Purpose and Need

The purpose of the black-tailed prairie dog inventory is to determine if the management goals and objective of 6-10 animals/acre are being met according to the Rocky Mountain Arsenal National Wildlife Refuge Comprehensive Management Plan (CMP) 1996, and Habitat Management Plan (HMP)(FWS 2013a).

The results of the survey will also be used for analysis in the 2015 Comprehensive Conservation Plan (CCP) to determine if the population densities of black-tailed prairie dogs are suitable for the reintroduction of black-footed ferrets (*Mustela nigripes*) within the established 2,585 acres of prairie dog management zones. The reintroduction of black-footed ferrets has been a priority for the Regional Director of the Mountain Prairie Region for fiscal years 2014 and 2015 (FWS 2013c, FWS 2014).

Methods

Survey methods and data analysis were based on established protocol (Biggins et al 1993). Three-meter wide transects spaced 60 meters apart were established running north to south within the boundaries of the management zone and varied in length. Transects started approximately 10 feet from the roads edge and run North to South ending either at the boundary of the management zone or the next intersecting road, which were approximately a mile apart. All transects were created as a shapefile in ArcGIS 10.2 and transfer to TerraSync software in a Trimble GeoXT handheld unit. A piece of 3-meter electrical conduit was attached to a backpack frame and chains were attached at each end of the conduit for a reference to the ground (Figure 2). Surveys should be conducted during mid-June through August after the young have emerged (Biggins et al 1993). The 2014 surveys started on August 4th and were completed on September 16th. The following is a list of design criteria:

- At least two individuals are needed to conduct the survey. One person carrying the Trimble unit with the pre-loaded transects and the backpack with the 3-meter pole, with the other person recording the number of active and inactive prairie dog burrow within the transect (Figure 1). The person with the Trimble unit and backpack, walks the transects, and the recorder walks behind them recording all burrows on the data sheet (Table 1). This procedure eliminates surveyor bias by eliminating the potential for the individual with the GPS and 3-meter pole from swerving to include or exclude burrows.
- All active and inactive burrow were recorded that were within the 3-meter transect pole and all burrows that were >50% within the chain hanging from the pole.
- Burrows were considered active if the opening is at least 7 cm, and the end is not visible. Large, badger-reamed burrows are counted because prairie dogs often keep using them after the badger departs (Biggins et al 1993). Burrows were further defined by the following criteria:
    - Fresh scat within 0.5 m of the burrow.
    - Vegetation clippings around entrance of burrow.
    - Burrows with spider webs and fresh debris in the entrance would not be disregarded as active as long as there was fresh scat within 0.5m.

In addition to the above mentioned methods, RMANWR staff established a partnership with the Denver Zoo to help determine prairie dog density within the management zones for the possible reintroduction of the black-footed ferrets. This partnership focused on piloting and testing an alternative to Biggins et al. 1993; by conducting a hundred percent inventory of active and inactive prairie dog burrows within the management zones (Eads et al 2011). Denver Zoo used the same methods as the RMANWR to determine if the burrows were active or inactive. However they conducted this method by utilizing staff and volunteers to locate all burrows within the management zones. Active burrows were marked with flour to prevent double counting. The data that was collected was then downloaded and digitized in the form of shapefile to be integrated with RMANWR survey data.

Results

Biggins et al. 1993 Transect Method

Approximately 107 miles of 3-meter wide transects (127 acres) were surveyed within the prairie dog management zones taking approximately two biological science technicians approximately 5-weeks to complete (Table 2). This effort surveyed approximately 5% of the 2,585 acres designated as prairie dog management zones. A five percent sample size is sufficient in determine overall population density (Biggins et al 1993).

Prairie Dog Density Formula:

The following formula was used to determine prairie dog densities, where 0.179 is the regression coefficient between counts and active burrows, and 0.566 is the observability index for black-tailed prairie dogs (Biggins et al. 1993).

$$\textit{Prairie Dog Density (dogs/ha)} = [0.179 * (\textit{active burrows per ha})]/0.566$$

To convert prairie dog density from hectares to acres we used the following formula.

Prairie Dogs Density (dogs per/acre) = (dogs/ha)/2.47

According to management goals established in the Habitat Management Plan (HMP) for the RMANWR, designated prairie dog management zones will be managed with a population density of 6-10 prairie dogs/acre (FWS 2013a, FWS 2013b). The total prairie dog population of all management zones averaged **19.16 PD/ac**. All management zones exceeded the population density of greater than 10 PD/ac (Table 3).

Eads et al. 2011 Method

The RMANWR and Denver Zoo staff completed the pilot surveys in portions of the eastern management zones of sections 20 and 30 and the southern management zone of section 8. That data was compiled in the form of a shapefile and sent to RMANWR and is included in the final 2014 survey maps (Map 5). We chose to analyze only the data collected in sections 20 and 30 as the data in collect in section 8 was considered a trial run to prepare for other areas of the refuge. The data collected in sections 20 and 30 was gathered in a more systematic approach.

The method developed by Eads and others (2011), produced very similar results to the transect method (Biggins et al. 1993). As described in Map 5, the Eads method produced a count of 10,119 burrows in an area of 85.1 hectares. This equated to an estimate of 37.6 PD/ha using the formulas described above. However, during data collection, it was estimated that approximately 10% of active burrows were being missed by observers. If a 10% missed detection probability rate is incorporated into the results, 11,130 active burrows should have been counted, thereby raising the density estimates to 41.4 PD /ha. The density estimate produced from transects in the same area was 41.7 PD/ha, or 0.3 less. While we did not conduct any statistical analyses of these differences, we felt they were biological identical.

While the data collected from this method will better allow the RMANWR staff to spatially portray the management zones for ferret reintroduction, it appears during the pilot testing of this method that a significant amount of time (3,120 hours) would be needed to complete all management zones (Table 4), and would primarily have to come from volunteers. Volunteers would also need to have a lead foreman to direct the survey pattern as it was noted that some areas were missed due to natural weaving of the surveyors.

Calculations for black-footed ferret

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. This spreadsheet (Table 5) incorporated revisions to earlier black-footed ferret energetic models (Biggins et al. 1993) that suggest that once prairie dog populations exceed 42 PD/ha, ferret populations do not increase (Biggins et al. 2006).

All prairie dog management zones exceeded the minimum requirements of good habitat (Biggins et al. 1993) of 12 PD/ha (4.85 PD/ac), and ranged from 39.25 PD/ha (15.89 PD/ac) to 78.26 prairie dogs/ha (31.68 PD/ac) (Tables 1 and 2). The established prairie dog management zones

exceed the habitat requirements for black-footed ferrets, and therefore provide suitable prairie dog populations for approximately 41 female black-footed-ferret families [an adult female, her 3.3 (average) young, and 0.5 males].

Management Recommendations

While the complete inventory (Eads et al. 2011) would lead to extremely fine-scale data, the authors believe that the transect survey method (Biggins et al. 1993) is the most practical, cost-effective, and repeatable approach that fulfills the management question *"What are the prairie dog population densities in the management zones?"* In addition, this method sets the stage for future long-term monitoring of prairie dog populations once ferrets are released at the RMANWR.

Areas of Improvement

The following items were identified to improve future prairie dog inventory surveys:

- Purchase an additional Trimble GPS unit to prevent a shortage of availability with other RMANWR staff.
- If possible, mowing of the prairie dog management zones prior to surveying would aid in spotting burrows in dense cover.
- Noting start and end points of large groups of burrows along transect lines may further define where the largest towns are located within the prairie dog management areas.
- Schedule more staff and volunteers in order to have more than one survey team per day.

Figure 1. Survey Team

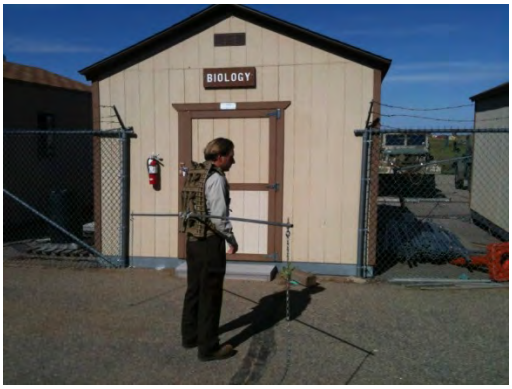

Figure 2. 3-meter Survey Backpack

Table 1. Prairie dog density data sheet.

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

Table 2. Cost estimates.

Cost for Biggins et al. 1993 method	**Cost/unit**	**# of Units**	**Total**
GS-5 Bio. Techs (2 positions @ 6 weeks each)	$18.43/hour	480 hours	$8,846
Assistant Refuge Manager (1 position @ 2 weeks – oversight)	$52.65/hour	80 hours	$4,212
Trimble GPS (1-time purchase) *still needed*	$6,000	1	$6,000
Sampling Equipment	$250	1	$250
Total			**$19,308**
Cost for Eads et al. 2011 method using volunteers	**Cost/unit**	**# of Units**	**Total**
Overtime for GS-5 Bio. Techs (2 positions @ 3 weeks each - leading groups on weekends)	$27.65/hour	240 hours	$6,636
Assistant Refuge Manager (1 position @ 2 weeks – coordination)	$52.65/hour	80 hours	$4,212
Garmin GPS units	$200	25	$5,000
Volunteers (20 volunteers for 26 days, working 6 hour days)	$0.00/hour	3,120 hours	$0
Total			**$15,848**

Table 3. Black-Tailed Prairie Dog Density Results by Management Zone.

2014 Black-Tailed Prairie Dog Density by Management Zones				
Management Zone(s)	**Area of Transects (m^2)**	**PD Count**	**PD Per/ha**	**PD Per/ac**
Eastern Zone	350,643	1,522	43.39	17.57
Northwest Zone	107,945	517	47.87	19.38
Southern Zones	45,019	352	78.26	31.68
Southwest Zones	8,299	33	39.25	15.89
Grand Total	*511,906*	*2,423*	***47.34***	***19.16***

Table 4. Black-Tailed Prairie Dog Density by Sections within the Management Zone.

2014 Black-Tailed Prairie Dog Density by Sections within the Management Zones				
Section	**Area of Transects (m^2)**	**PD Count**	**PD Per/ha**	**PD Per/ac**
2	2,584	12	46.51	18.83
3	5,715	21	35.97	14.56
5	49,595	189	38.13	15.44
7	24,081	186	77.35	31.32
8	10,648	20	19.01	7.70
11/12	20,938	166	79.30	32.10
19	62,864	306	48.60	19.67
20	20,223	80	39.72	16.08
22	34,820	181	51.86	21.00
23	12,056	35	29.38	11.89
27	56,838	277	48.74	19.73
28	4,231	24	56.06	22.70
29	95,833	445	46.40	18.78
30	37,980	174	45.80	18.54
32	73,500	308	41.87	16.95
Grand Total	*511,906*	*2,423*	***47.34***	***19.16***

Table 5. BFF Evaluation

Section	Management Zone	N	PROP GOOD	HA	HA GOOD	BUR/ HA	PD/ HA	PD EST	Rating **1993** PD/ 763	>18 PDs	>=42 PDs	Rating **2006** If 1993 rating <2
2	Southwest	6	0.897	5.3	4.8	164.0	51.9	249.0	0.33	0.19	0.19	0.33
3	Southwest	10	0.844	11.4	9.6	130.6	41.3	396.5	0.52	0.38	0.38	0.52
7	Southern	16	1.000	47.0	47.0	244.6	77.4	3635.7	4.77	0.95	1.88	1.88
11/12	Southern	20	1.000	41.1	41.1	250.7	79.3	3258.6	4.27	0.73	1.64	1.64
5	Eastern	12	1.000	97.6	97.6	120.6	38.1	3722.5	4.88	3.79	3.79	3.79
8	Eastern	9	0.444	20.7	9.2	117.4	37.1	341.6	0.45	0.35	0.35	0.45
19	Eastern	23	1.000	128.5	128.5	153.7	48.6	6244.9	8.18	5.16	5.14	5.14
20	Eastern	15	1.000	41.8	41.8	125.6	39.7	1660.4	2.18	1.64	1.64	1.64
29	Eastern	26	0.962	194.0	186.5	149.4	47.2	8811.8	11.55	7.51	7.46	7.46
30	Eastern	23	1.000	77.4	77.4	144.8	45.8	3544.4	4.65	3.12	3.10	3.10
32	Eastern	27	1.000	149.5	149.5	132.4	41.9	6259.9	8.20	5.96	5.96	5.96
22	Northwest	21	1.000	77.0	77.0	164.0	51.9	3993.7	5.23	3.05	3.08	3.08
23	Northwest	8	1.000	26.4	26.4	92.9	29.4	775.6	1.02	0.90	0.90	1.02
27	Northwest	27	1.000	114.9	114.9	154.1	48.7	5599.6	7.34	4.61	4.60	4.60
28	Northwest	6	1.000	11.6	11.6	177.3	56.1	650.4	0.85	0.44	0.46	0.85
Total (or mean)		249	0.980	1044.2	1022.9	154.8	49.0	49144.7	64.41	38.81	40.59	41.45

Notes:

N = Number of transects
PROP GOOD = Proportion of good habitat (transects with > than 12 prairie dogs per hectare
HA = Hectares of prairie dog habitat within the management zone for each section
HA GOOD = Hecares of good prairie dog habitat in each section
BUR/HA = Active burrows per hectare
PD/HA = Prairie dogs per hectare (=BURperHA*0.179/0.566)
PD EST= Estimated prairie dogs in each section
Rating 1993 PD/763 = Old (Biggins et al. 1993) linear conversion of PDs to BFFs (PD/763)
>18 PDs = New (Biggins et al. 2006) conversion of PDs to BFFs incorporates an increasing effect of BFF territoriality when PD density > 18/ha
>=42 PDs = New rating shows no increase in rating if PD density => 42 PDs/ha
Rating 2006 If 1993 rating <2 = New rating uses 1993 rating if there are less than 2 BFFs per colony because of presumed lack of competition (see Biggins et al. 2006, p. 147)

References

Biggins D.E., Brian J. Miller, Louis R. Hanebury, Bob Oakleaf, Adrian H. Farmer, Ron Crete, Arnold Dood. 1993. A Technique for Evaluating Black-footed Ferret Habitat. U.S. Fish and Wildlife Service, National Ecology Research Center, Fort Collins, Colorado. July 1993. Biological Report 13: 73-88.

Biggins, D.E., J.M. Lockhart, and J.L. Godbey. 2006c. Evaluating habitat for black-footed ferrets: revision of an existing model. Pp. 143–152 in J.E. Rolle, B.J. Miller, J.L. Godbey, and D.E. Biggins, eds., Recovery of the black-footed ferret — progress and continuing challenges. U.S. Geological Survey Scientific Investigations Report 2005-5293, U.S. Geological Survey, Reston, Va.

Eads D.A., Joshua J. Millspaugh, Dean E. Biggins, David S. Jachowski, and Travis M. Livieri. 2011. Evaluation of a Black-Footed Ferret Resource Utilization Function Model Journal of Wildlife Management, 75(5):1155-1163.

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[FWS] U.S. Fish and Wildlife Service. 2013b. Management of black-tailed prairie dog (Cynomys ludovicianus) populations on the Rocky Mountain Arsenal National Wildlife Refuge. Commerce City, Colorado: U.S. Department of the Interior, Fish and Wildlife Service, Rocky Mountain Arsenal National Wildlife Refuge.

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[FWS] U.S. Fish and Wildlife Service. 2014. Mountain-Prairie Region FY15 Regional Priorities. U.S. Department of the Interior, Fish and Wildlife Service, Mountain-Prairie Region, Lakewood, Colorado.

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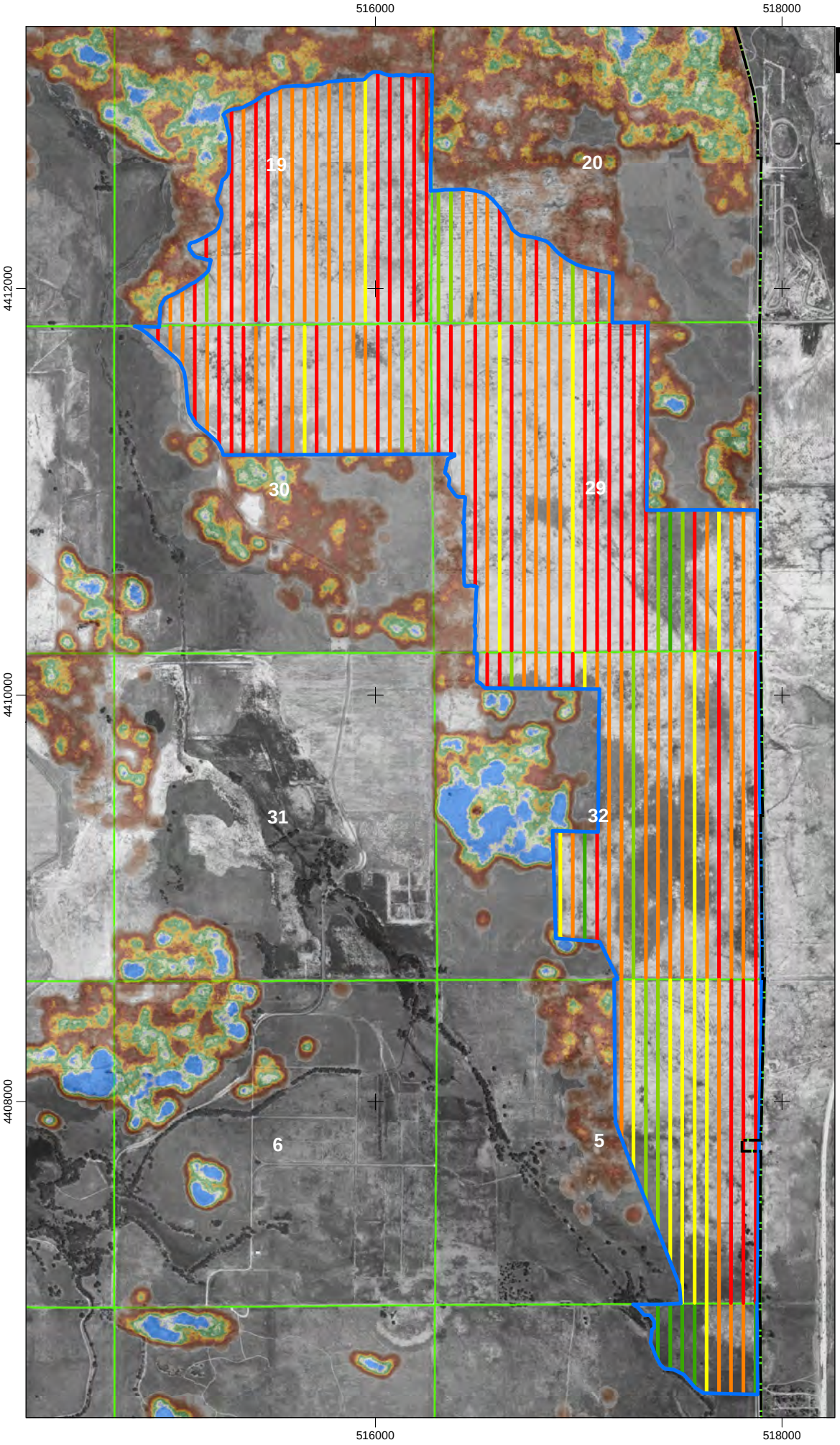


Aerial photography taken August 6, 2013

U.S. Fish & Wildlife Service

Rocky Mountain Arsenal
National Wildlife Refuge

Black-Tailed Prairie Dog Management Program

Eastern RMA Zone

Legend

- *RMANWR Boundary*
- Prairie Dog Mgmt Zones (2585 Acres)
- RMANWR Sections

Prairie Dogs per Acre

- 0.00 - 6.00
- 6.01 - 10.00
- 10.01 - 14.00
- 14.01 - 20.00
- 20.01 - 72.79

Estimated 2013 Prairie Dog Burrow Density and Distribution Outside Prairie Dog Zones

High (28/acre)

Low (0.5/acres)

N

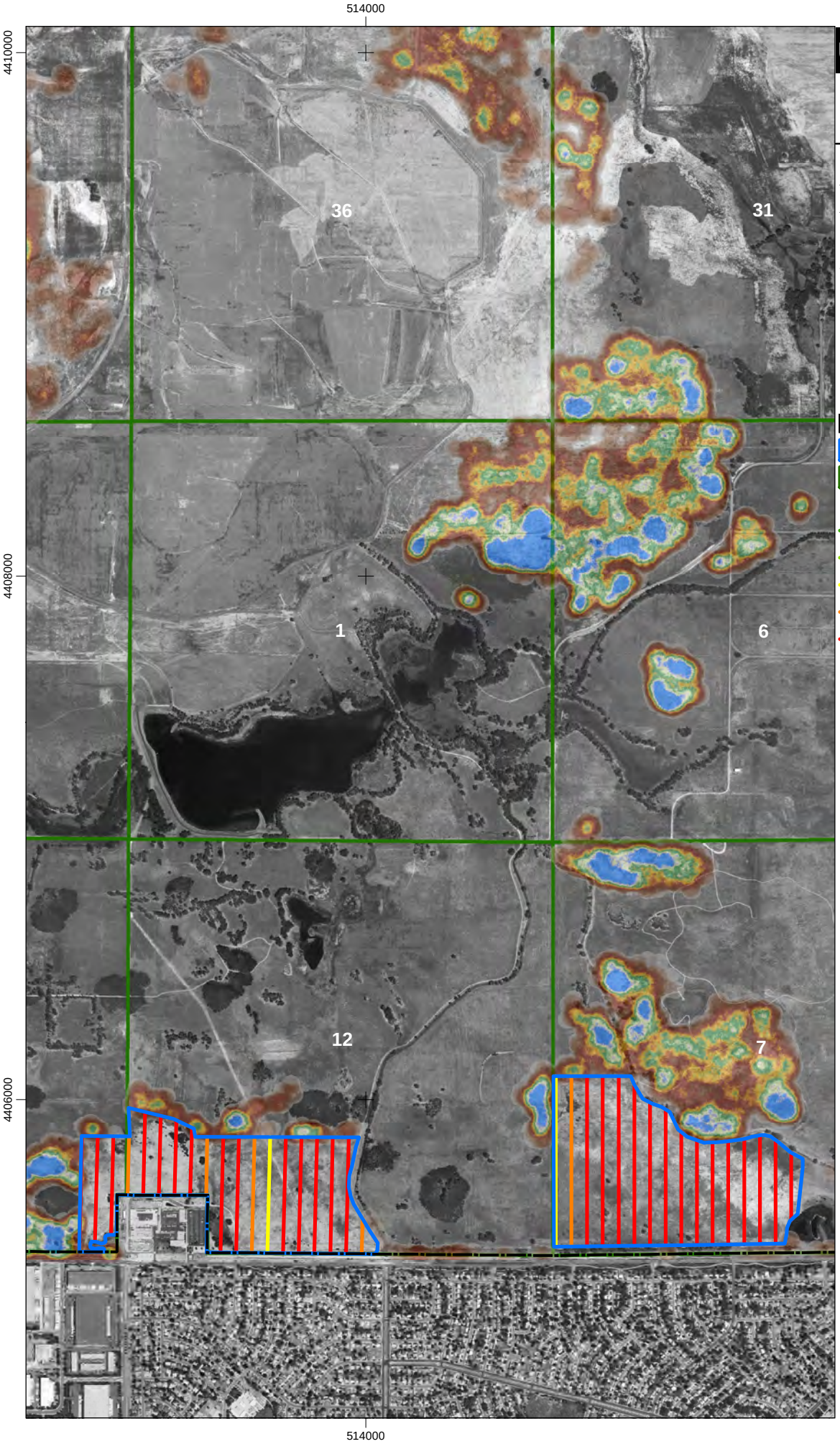
0 0.25 0.5 0.75

Miles

Transverse Mercator Projection
UTM Zone 13 North, Units Meters
North American Datum 1983
Data Sources: USFWS, U.S. Army, RVO GIS Dept.

2014

Black-Tailed Prairie Dog Density and Activity Survey



Aerial photography taken August 6, 2013

U.S. Fish & Wildlife Service

Rocky Mountain Arsenal
National Wildlife Refuge

Black-Tailed Prairie Dog Management Program

Southern Zones

Legend

- *RMANWR Boundary*
- Prairie Dog Mgmt Zones (2585 Acres)
- RMANWR Sections

Prairie Dogs per Acre

- 0.00 - 6.00
- 6.01 - 10.00
- 10.01 - 14.00
- 14.01 - 20.00
- 20.01 - 72.79

Estimated 2013 Prairie Dog Burrow Density and Distribution Outside Prairie Dog Zones

High (28/acre)

Low (0.5/acres)

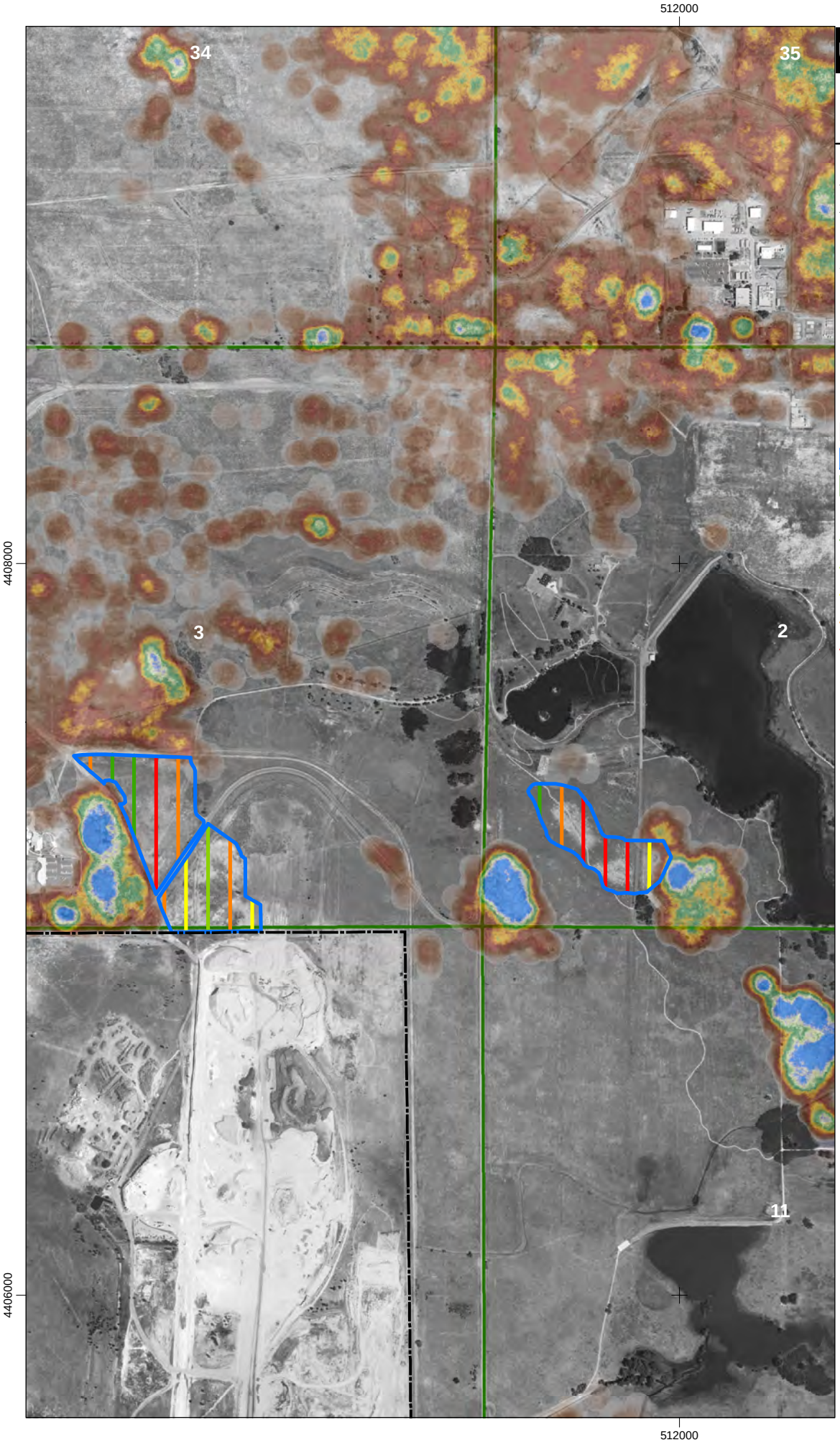
N

0 0.25 0.5

Miles

Transverse Mercator Projection
UTM Zone 13 North, Units Meters
North American Datum 1983
Data Sources: USFWS, U.S. Army, RVO GIS Dept.

2014
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

Legend

- *RMANWR Boundary*
- Prairie Dog Mgmt Zones (2585 Acres)
- RMANWR Sections

Prairie Dogs per Acre

- 0.00 - 6.00
- 6.01 - 10.00
- 10.01 - 14.00
- 14.01 - 20.00
- 20.01 - 72.79

Estimated 2013 Prairie Dog Burrow Density and Distribution Outside Prairie Dog Zones

High (28/acre)

Low (0.5/acres)

N

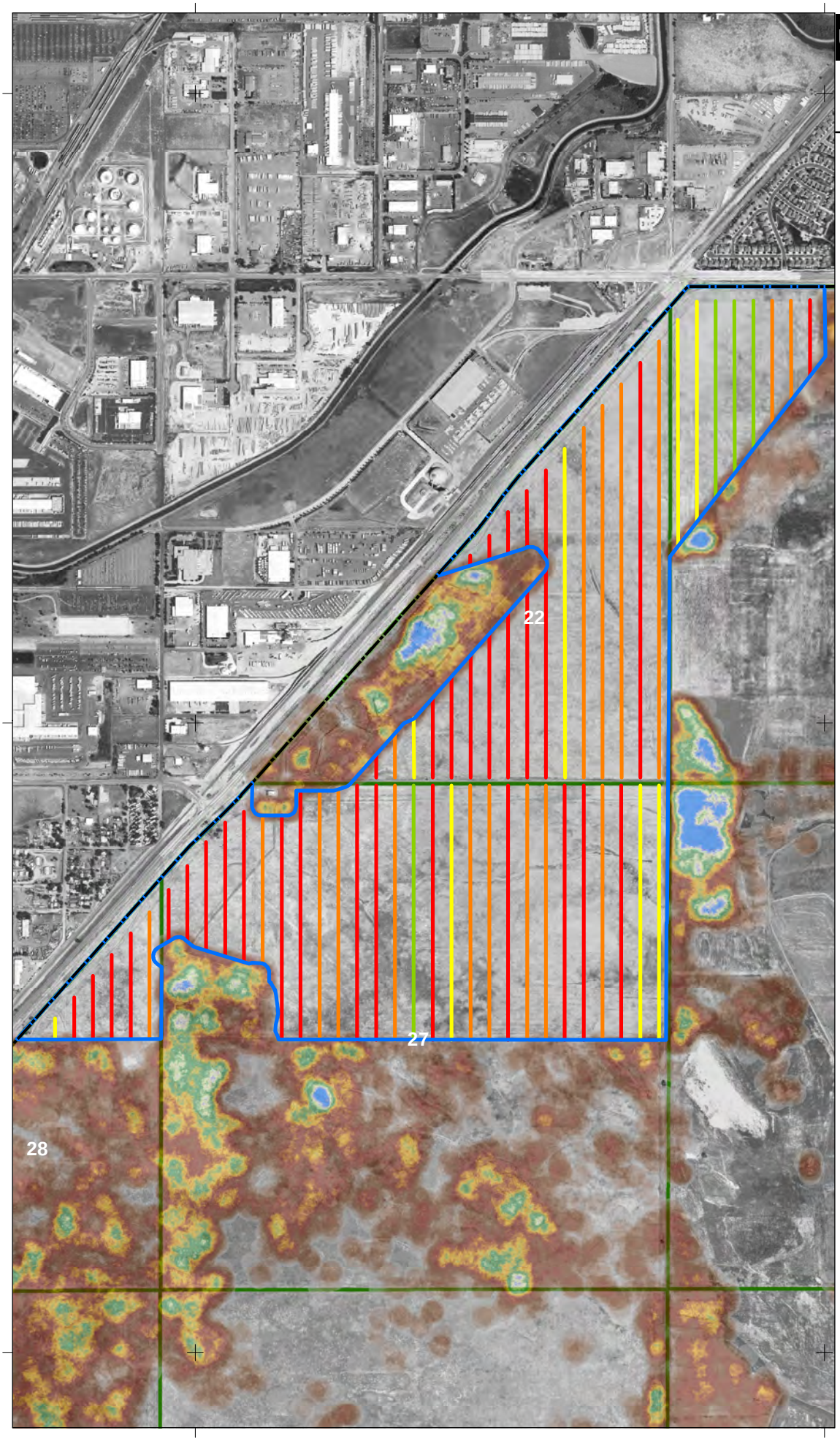
0 0.15 0.3

Miles

Transverse Mercator Projection
UTM Zone 13 North, Units Meters
North American Datum 1983
Data Sources: USFWS, U.S. Army, RVO GIS Dept.

2014
Black-Tailed Prairie Dog Density and Activity Survey

Aerial photography taken August 6, 2013



Aerial photography taken August 6, 2013

U.S. Fish & Wildlife Service

Rocky Mountain Arsenal
National Wildlife Refuge

Black-Tailed Prairie Dog Management Program

Northwest RMA Zone

Legend

- *RMANWR Boundary*
- Prairie Dog Mgmt Zones (2585 Acres)
- RMANWR Sections

Prairie Dogs per Acre

- 0.00 - 6.00
- 6.01 - 10.00
- 10.01 - 14.00
- 14.01 - 20.00
- 20.01 - 72.79

Estimated 2013 Prairie Dog Burrow Density and Distribution Outside Prairie Dog Zones

High (28/acre)

Low (0.5/acres)

N

0 0.2 0.4 Miles

Transverse Mercator Projection
UTM Zone 13 North, Units Meters
North American Datum 1983
Data Sources: USFWS, U.S. Army, RVO GIS Dept.

2014
Black-Tailed Prairie Dog Density and Activity Survey

516000

Biggins et al. 1993 Transect Method:

- Area surveyed = 4.2ha
- Active burrows counted = 549
- Density estimate = 41.7 prairie dogs/ha (16.9 /acre)

Eads et al. 2011 Census Method:

- Area surveyed = 85.1ha
- Active burrows counted = 10,119
- Density estimate = 37.6 prairie dogs/ha (15.2 /acre)
- Density estimate including ~10% detection probability factor = 41.4 prairie dogs/ha (16.8 /acre)

4412000

An example of an area missed during census (~10% detection factor)

516000

Aerial photography taken August 6, 2013

U.S. Fish & Wildlife Service

Rocky Mountain Arsenal

National Wildlife Refuge

Black-Tailed Prairie Dog Management Program

EasternZone
Denver Zoo Data

Legend

- Comparison Area
- *RMANWR Boundary*
- Prairie Dog Mgmt Zones (2585 Acres)
- RMANWR Sections

Biggins Method (PDs/acre)

- 0.00 - 6.00
- 6.01 - 10.00
- 10.01 - 14.00
- 14.01 - 20.00
- 20.01 - 72.79
- Active Burrows (Eads Method)
- Inactive Burrows (Eads Method)

2013 Prairie Dog Burrow Density and Distribution Outside Prairie Dog Zones

High (16/acre)

Low (0.5/acres)

N

0 0.15 0.3

Miles

Transverse Mercator Projection
UTM Zone 13 North, Units Meters
North American Datum 1983
Data Sources: USFWS, U.S. Army, RVO GIS Dept.

2014

Black-Tailed Prairie Dog Density and Activity Survey

Transverse Mercator Projection UTM Zone 13 North, Units Meters North American Datum 1983

Section 2					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
4_2_36	511619 511619	4407398 4407309	89.0	0	2
4_2_38	511739 511739	4407361 4407179	181.6	13	0
4_2_37	511679 511679	4407395 4407225	169.6	6	0
4_2_40	511859 511859	4407244 4407100	144.1	7	0
4_2_39	511799 511799	4407254 4407112	142.0	8	1
4_2_41	511919 511919	4407242 4407107	135.0	4	1
Total			861.3	38.00	4.00

Section 3					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
3_3_49	510713 510713	4407288 4406993	294.5	6	1
3_3_48	510653 510653	4407197 4406993	203.2	6	0
3_3_47	510593 510593	4407109 4407040	69.1	3	0
3_3_50	510773 510773	4407246 4406994	251.5	9	2
3_3_51	510833 510833	4407081 4406995	85.2	2	2
5_3_46	510631 510631	4407186 4407470	284.9	11	1
5_3_45	510571 510571	4407098 4407473	374.4	24	0
5_3_44	510511 510511	4407251 4407475	224.0	2	0
5_3_43	510451 510451	4407405 4407478	72.8	0	0
5_3_42	510391 510391	4407432 4407477	45.4	2	0
Total			1904.9	65.00	6.00

Transverse Mercator Projection UTM Zone 13 North, Units Meters North American Datum 1983

Section 5					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
6_5_111	517870 517870	4408599 4407010	1588.8	88	15
6_5_112	517810 517810	4408599 4407010	1588.7	78	10
6_5_113	517750 517750	4408598 4407010	1588.5	93	4
6_5_114	517690 517690	4408601 4407012	1588.3	56	2
6_5_115	517630 517630	4408597 4407009	1588.1	41	11
6_5_116	517570 517570	4408597 4407009	1587.9	44	5
6_5_117	517510 517510	4408597 4407009	1587.7	52	6
6_5_118	517450 517450	4408597 4407212	1384.7	40	13
6_5_119	517390 517390	4408597 4407363	1234.1	26	6
6_5_120	517330 517330	4408597 4407513	1084.4	23	1
6_5_121	517270 517270	4408597 4407663	933.9	24	8
6_5_122	517210 517210	4408595 4407818	776.7	33	11
Total			16531.6	598.00	92.00

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Section 7					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
2_7_1	514727 514727	4406089 4405437	652.1	17	1
2_7_2	514787 514787	4406089 4405438	651.2	24	1
2_7_3	514847 514847	4406089 4405439	650.2	46	0
2_7_4	514907 514907	4406089 4405440	649.2	39	0
2_7_5	514967 514967	4406089 4405441	648.3	45	0
2_7_6	515027 515027	4406058 4405441	616.9	38	0
2_7_7	515087 515087	4405989 4405442	546.7	29	2
2_7_8	515147 515147	4405962 4405442	519.6	55	0
2_7_9	515207 515207	4405876 4405443	432.5	35	1
2_7-10	515267 515267	4405844 4405444	400.1	48	0
2_7_11	515327 515327	4405836 4405444	392.1	43	0
2_7_12	515387 515387	4405841 4405445	395.5	54	0
2_7_13	515447 515447	4405849 4405446	402.9	39	0
2_7_14	515507 515507	4405863 4405447	415.5	37	0
2_7_15	515567 515567	4405845 4405448	397.1	20	0
2_7_16	515627 515627	4405797 4405540	257.1	20	0
Total			8026.9	589.00	5.00

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Section 8					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
6_8_102	517390 517390	4407003 4406725	277.9	0	0
6_8_103	517450 517450	4407003 4406683	320.0	0	0
6_8_104	517510 517510	4407003 4406660	343.1	1	0
6_8_105	517570 517570	4407003 4406596	407.0	1	0
6_8_106	517630 517630	4407004 4406566	437.8	13	1
6_8_107	517690 517690	4407004 4406564	439.6	19	0
6_8_108	517750 517750	4407004 4406562	441.3	15	1
6_8_109	517810 517810	4407004 4406562	441.4	15	0
6_8_110	517870 517870	4407004 4406562	441.4	0	1
Total			3549.5	64.00	3.00

Transverse Mercator Projection UTM Zone 13 North, Units Meters North American Datum 1983

Sections 11/12					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
1_11_17	512905 512915	4405418 4405860	442.5	51	1
1_11_19	513026 513035	4405483 4405860	376.9	41	5
1_12_20	513090 513095	4405634 4405859	225.1	9	0
1_12_21	513150 513157	4405633 4405952	318.3	27	2
1_12_25	513390 513395	4405633 4405857	224.4	9	0
1_12_26	513445 513455	4405415 4405857	442.1	24	0
1_12_27	513505 513515	4405415 4405857	442.5	26	0
1_12_28	513565 513575	4405414 4405857	442.8	20	0
1_12_29	513625 513635	4405413 4405856	443.1	11	0
1_12_30	513685 513695	4405413 4405856	443.5	23	0
1_12_31	513745 513755	4405412 4405856	443.8	30	0
1_12_32	513805 513815	4405412 4405856	444.2	31	0
1_12_33	513865 513875	4405411 4405856	444.5	40	0
1_12_34	513925 513935	4405411 4405855	444.9	29	0
1_12_35	513985 513988	4405410 4405545	135.4	6	0
1_12_22	513210 513217	4405633 4405937	304.2	48	8
1_12_23	513270 513277	4405634 4405920	286.7	30	0
1_12_24	513330 513336	4405633 4405892	258.9	28	0
1_11_18	512965 512965	4405418 4405430	403.7	40	2
1_11_16	512966 512975	4405456 4405860	11.7	2	0
Total			6979.3	525.00	18.00

Transverse Mercator Projection UTM Zone 13 North, Units Meters North American Datum 1983

Section 19					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
6_19_215	516251 516251	4411844 4413050	1206.4	68	7
6_19_216	516191 516191	4411844 4413051	1207.7	78	5
6_19_217	516131 516131	4411844 4413052	1208.8	58	8
6_19_218	516071 516071	4411844 4413050	1206.3	59	19
6_19_219	516011 516011	4411844 4413066	1222.0	60	14
6_19_220	515951 515951	4411844 4413035	1191.1	38	24
6_19_221	515891 515891	4411844 4413026	1182.1	40	20
6_19_222	515831 515831	4411844 4413023	1179.3	47	5
6_19_223	515771 515771	4411844 4413018	1174.4	47	4
6_19_224	515711 515711	4411844 4413005	1161.7	47	3
6_19_225	515651 515651	4411844 4412998	1154.1	43	9
6_19_226	515591 515591	4411844 4412997	1153.5	50	0
6_19_227	515531 515531	4411844 4412990	1146.1	53	9
6_19_228	515471 515471	4411844 4412962	1118.4	65	0
6_19_229	515411 515411	4411844 4412925	1081.7	59	3
6_19_230	515351 515351	4411844 4412894	1050.2	47	2
6_19_231	515291 515291	4411844 4412879	1035.6	56	1
6_19_232	515231 515231	4411844 4412314	470.7	19	7
6_19_233	515171 515171	4411844 4412080	236.0	5	0
6_19_234	515111 515111	4411844 4412032	188.2	10	1
6_19_235	515051 515051	4411844 4411996	152.3	5	0
6_19_236	514991 514991	4411844 4411965	121.0	4	0
6_19_237	515167 515168	4412144 4412251	107.0	8	1
Total:			20954.7	966	142

Transverse Mercator Projection UTM Zone 13 North, Units Meters North American Datum 1983

Section 20					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
6_20_200	517151 517151	4411844 4412080	236.0	11	3
6_20_201	517091 517091	4411844 4412090	246.7	14	4
6_20_202	517031 517031	4411844 4412104	260.5	9	3
6_20_203	516971 516971	4411844 4412128	284.8	5	1
6_20_204	516911 516911	4411844 4412167	322.9	11	3
6_20_205	516851 516851	4411844 4412226	382.1	14	5
6_20_206	516791 516791	4411844 4412248	404.1	27	3
6_20_207	516731 516731	4411844 4412259	415.0	18	1
6_20_208	516671 516671	4411844 4412296	452.8	18	3
6_20_209	516611 516611	4411844 4412398	554.7	30	5
6_20_210	516551 516551	4411844 4412460	616.8	25	4
6_20_211	516491 516491	4411844 4412480	636.8	21	8
6_20_212	516431 516431	4411844 4412488	644.9	27	4
6_20_213	516371 516371	4411844 4412488	644.3	12	10
6_20_214	516311 516311	4411844 4412482	638.5	12	8
Total:			6741.0	254	65

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Section 22					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
7_22_86	511474 511474	4411825 4413213	1387.3	48	9
7_22_87	511414 511414	4411825 4413144	1318.8	67	10
7_22_88	511354 511354	4411825 4413076	1250.8	43	4
7_22_89	511294 511294	4411825 4413007	1181.8	49	3
7_22_90	511234 511234	4411825 4412938	1112.8	41	1
7_22_91	511174 511174	4411825 4412870	1044.5	28	0
7_22_98	511114 511114	4411825 4412487	254.7	14	0
7_22_99	511114 511114	4412520 4412803	188.5	6	0
7_22_100	511054 511054	4411825 4412419	141.1	6	0
7_22_101	511054 511054	4412558 4412737	73.3	5	0
7_22_97	510994 510994	4411825 4412351	322.4	34	0
7_22_96	510994 510994	510994 510994	390.1	35	1
7_22_95	510934 510934	4411825 4412283	457.9	25	1
7_22_94	510934 510934	4412519 4412594	525.6	35	2
7_22_93	510874 510874	4411825 4412216	593.3	44	1
7_22_92	510874 510874	4412500 4412532	661.7	39	0
7_22_103	510814 510814	4411825 4412148	32.1	5	0
7_22_104	510754 510754	4411825 4412080	75.3	5	0
7_22_105	510694 510694	4411825 4412014	132.2	8	0
7_22_106	510634 510634	4411825 4411967	179.5	12	0
7_22_107	510574 510574	4411825 4411899	283.1	22	1
Total			11606.8	571.00	33.00

Transverse Mercator Projection UTM Zone 13 North, Units Meters North American Datum 1983

Section 23					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
7_23_245	511534 511534	4412561 4413281	720.238334	20	1
7_23_244	511594 511594	4412638 4413339	700.927581	22	2
7_23_243	511654 511654	4412715 4413340	624.354073	13	4
7_23_242	511714 511714	4412793 4413340	547.780814	8	3
7_23_241	511774 511774	4412870 4413341	471.207305	11	1
7_23_240	511834 511834	4412947 4413342	394.633546	13	1
7_23_239	511894 511894	4413024 4413342	318.060037	12	1
7_23_238	511954 511954	4413101 4413343	241.486778	13	0
Total			4018.69	112.00	13.00

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Section 27					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
7_27_85	511474 511474	4410992 4411801	808.2	21	1
7_27_84	511414 511414	4410992 4411801	808.2	23	0
7_27_83	511354 511354	4410992 4411801	808.2	43	3
7_27_82	511294 511294	4410992 4411801	808.2	28	1
7_27_81	511234 511234	4410992 4411801	808.2	46	0
7_27_80	511174 511174	4410992 4411801	808.2	50	0
7_27_79	511114 511114	4410992 4411801	808.2	36	1
7_27_78	511054 511054	4410992 4411801	808.2	29	3
7_27_77	510994 510994	4410992 4411801	808.2	44	2
7_27_76	510934 510934	4410992 4411801	808.2	35	1
7_27_75	510874 510874	4410992 4411801	808.2	28	0
7_27_74	510814 510814	4410992 4411801	808.2	20	0
7_27_73	510754 510754	4410992 4411801	808.2	41	2
7_27_72	510694 510694	4410992 4411801	808.2	17	1
7_27_71	510634 510634	4410992 4411801	808.2	34	1
7_27_70	510574 510574	4410992 4411801	808.2	42	2
7_27_69	510514 510514	4410992 4411801	808.2	55	4
7_27_68	510454 510454	4410994 4411788	794.1	37	1
7_27_67	510394 510394	4410994 4411784	790.3	34	3
7_27_66	510334 510334	4410994 4411784	790.2	41	3
7_27_65	510274 510274	4410994 4411705	710.9	43	0
7_27_64	510214 510214	4411235 4411705	470.8	21	0
7_27_63	510154 510154	4411240 4411718	478.0	31	1
7_27_62	510094 510094	4411258 4411683	425.1	31	0
7_27_61	510034 510034	4411276 4411620	343.9	17	0
7_27_60	509974 509974	4411306 4411544	238.9	14	0
7_27_59	509914 509914	4411305 4411469	164.2	15	1
Total			18946.2	876.00	31.00

Transverse Mercator Projection UTM Zone 13 North, Units Meters North American Datum 1983

Section 28					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
7_28_58	509854 509854	4410994 4411398	403.7	16	2
7_28_57	509794 509794	4410994 4411331	336.2	16	0
7_28_56	509734 509734	4410994 4411263	268.7	20	1
7_28_55	509674 509674	4410994 4411195	201.2	12	0
7_28_54	509614 509614	4410994 4411128	133.7	9	0
7_28_53	509554 509554	4410994 4411060	66.6	2	0
Total			1410.2	75.00	3.00

Transverse Mercator Projection UTM Zone 13 North, Units Meters North American Datum 1983

Section 29					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
6_29_151	517811 517811	4410224 4410911	1374.1	46	2
6_29_152	517751 517751	4410912 4410224	687.5	28	3
6_29_153	517691 517691	4410911 4410225	686.6	21	5
6_29_154	517631 517631	4410911 4410225	686.6	31	3
6_29_155	517571 517571	4410911 4410225	686.6	33	0
6_29_156	517511 517511	4410911 4410225	686.6	13	11
6_29_157	517451 517451	4410911 4410224	687.3	5	6
6_29_158	517391 517391	4410911 4410224	687.3	14	1
6_29_159	517331 517331	4411823 4410224	1599.6	107	3
6_29_160	517271 517271	4411823 4410223	1599.7	89	1
6_29_161	517211 517211	4411823 4410221	1602.2	80	5
6_29_162	517151 517151	4411823 4410221	1602.3	91	2
6_29_163	517091 517091	4411823 4410221	1602.4	105	2
6_29_164	517031 517031	4411818 4410221	1596.6	87	3
6_29_165	516971 516971	4411818 4410220	1598.0	44	2
6_29_166	516911 516911	4411818 4410219	1598.1	63	2
6_29_167	516851 516851	4411818 4410219	1598.2	62	1
6_29_168	516791 516791	4411818 4410219	1598.3	54	3
6_29_169	516731 516731	4411816 4410220	1596.4	63	1
6_29_170	516671 516671	4411816 4410220	1596.5	75	1
6_29_171	516611 516611	4411816 4410220	1596.6	51	5
6_29_172	516551 516551	4411816 4410219	1596.8	57	12
6_29_173	516491 516491	4411816 4410536	1280.0	72	7
6_29_174	516431 516431	4411816 4410976	840.6	32	0
6_29_175	516371 516371	4411816 4411185	631.1	40	2
6_29_176	516311 516311	4411813 4411185	628.3	43	4
Total:			31944.3	1406	87

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Section 30					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
6_30_177	516251 516251	4411813 4411185	628.1	24	2
6_30_178	516191 516191	4411813 4411185	628.3	22	15
6_30_179	516131 516131	4411813 4411185	628.1	13	7
6_30_180	516071 516071	4411813 4411184	629.1	21	3
6_30_181	516011 516011	4411813 4411184	629.3	32	4
6_30_182	515951 515951	4411812 4411184	628.2	23	11
6_30_183	515891 515891	4411812 4411184	628.4	27	3
6_30_184	515831 515831	4411812 4411183	628.6	24	3
6_30_185	515771 515771	4411812 4411183	628.8	29	7
6_30_186	515711 515711	4411812 4411183	629.0	40	1
6_30_187	515651 515651	4411812 4411183	629.1	16	5
6_30_188	515591 515591	4411812 4411183	629.3	27	5
6_30_189	515531 515531	4411808 4411182	625.5	39	0
6_30_190	515471 515471	4411808 4411182	626.2	26	6
6_30_191	515411 515411	4411809 4411182	627.0	23	0
6_30_192	515352 515352	4411809 4411182	627.7	34	0
6_30_193	515291 515291	4411810 4411182	628.4	32	2
6_30_194	515231 515231	4411811 4411229	582.2	30	4
6_30_195	515171 515171	4411811 4411292	519.7	20	5
6_30_196	515111 515111	4411812 4411347	464.5	29	3
6_30_197	515051 515051	4411813 4411607	205.7	8	0
6_30_198	514991 514991	4411813 4411682	131.1	6	0
6_30_199	514931 514931	4411812 4411734	77.9	5	0
Total:			12659.9	550	86

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Section 32					
Transect Name	X	Y	Transect Length	# Active Burrows	# Inactive Burrows
6_32_140	517091 517091	4410204 4410031	173.4	6	2
6_32_141	517031 517031	4410204 4410031	172.9	5	0
6_32_142	516971 516971	4410203 4410032	172.0	13	0
6_32_143	516911 516911	4410203 4410032	171.5	10	0
6_32_144	516851 516851	4410203 4410032	171.0	8	0
6_32_145	516791 516791	4410203 4410033	170.5	7	1
6_32_146	516731 516731	4410202 4410033	169.4	6	1
6_32_147	516671 516671	4410202 4410033	168.9	3	0
6_32_148	516611 516611	4410202 4410034	168.6	8	0
6_32_149	516551 516551	4410202 4410034	167.9	12	0
6_32_123	517871 517870	4410208 4408614	1593.6	98	8
6_32_124	517810 517811	4408614 4410208	1594.1	61	18
6_32_125	517751 517750	4410208 4408613	1594.6	73	14
6_32_126	517691 517690	4410207 4408613	1594.8	76	4
6_32_127	517631 517630	4410207 4408612	1595.2	71	7
6_32_128	517571 517570	4410207 4408611	1595.7	50	5
6_32_129	517511 517510	4410207 4408611	1596.2	57	15
6_32_130	517451 517450	4410205 4408610	1594.5	56	14
6_32_131	517391 517390	4410205 4408610	1595.0	67	10
6_32_132	517331 517330	4410205 4408609	1595.5	55	10
6_32_133	517271 517270	4410204 4408608	1596.0	33	10
6_32_134	517211 517210	4410204 4408608	1596.5	56	1
6_32_135	517151 517150	4410204 4408689	1515.4	58	13
6_32_136	517090 517090	4409327 4408788	539.0	37	5
6_32_137	517030 517030	4409329 4408793	535.8	7	12
6_32_138	516970 516970	4409331 4408798	532.7	24	5
6_32_139	516910 516910	4409332 4408803	529.6	16	8
Total			24500.1	973.00	163.00