Attachment C

USFWS Eagle Fatality Modeling

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U.S. Fish and Wildlife Service Summary Document for Review of Eagle Use Data and Eagle Fatality Prediction Analysis for the Chokecherry and Sierra Madre Wind Energy Project Phase 1

U.S. Fish and Wildlife Service, Region 6, Wyoming Ecological Services Field Office
and Region 6 Migratory Bird Management Office

May 27, 2014

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U.S. Fish and Wildlife Service Summary Document for Review of Eagle Use Data and Eagle Fatality Prediction Analysis for the Chokecherry and Sierra Madre (CCSM) Wind Energy Project Phase 1

Executive Summary

This document describes the data, decision criteria, and methods used by the U.S. Fish and Wildlife Service (USFWS) to calculate the estimated bald eagle and golden eagle fatalities associated with Phase 1 of the Chokecherry Sierra Madre Wind Energy Project. The methods used by the USFWS generally followed recommendations in the Eagle Conservation Plan Guidance (ECPG 2013), such as using data from points counts that fall within 1 kilometer of the project footprint (ECPG 2013, p. 57).

The number of estimated eagle fatalities was calculated using long-watch data collected from April 2011 to July 2012 and 800-meter (0.5 mile) point count data collected from August 2012 to August 2013. The data were collected over two and a half years using varying methods (i.e., observer distances, eagle flight heights, surveys periods, and number of survey points); therefore, the data could not be easily combined into a single model run. Because of the varying survey effort and volumes, the data were stratified by sampling methodology.

Data from April 2011 to July 2012 were collected using similar long-watch methods, so data from the 16 months were combined into one year of data (Year1) and were run independently of the other four survey periods (Fall 2012, Winter 2012, Spring 3013, Summer 2013). Because the eagle fatality model uses a Bayesian framework, the posterior from Year1 was used to inform Year2 as the new prior.

The second "year" (Year2, August 2012 to August 2013) was collected over 13 months from different numbers of survey points using different eagle flight heights. Data from the 13 months of Year2 were pooled and used to predict fatalities for one 12-month year; however, the code in the eagle fatality model was modified to account for different survey volumes and hazardous area volumes. In model runs for both years, daylight hours were adjusted to account for curtailment of 17 turbines during the spring.

Estimates of golden eagle fatalities and bald eagle fatalities were calculated for Chokecherry and for Sierra Madre using two different turbine sizes. Using the largest on-shore turbine anticipated (120-meter diameter blade), the 80 percent upper credible interval (80% UCI) from the USFWS peer-reviewed model predicts 14 golden eagle fatalities and 2 bald eagle fatalities annually for Phase 1 of the Chokecherry and Sierra Madre Wind Energy Project. Using a smaller turbine (103-meter blade), the model predicts the 80% UCI for 500 turbines of Phase 1 will result in 10 golden eagle and 1.4 bald eagle fatalities annually.

POINT COUNTS TO INCLUDE/EXCLUDE FROM EAGLE FATALITY MODELING

Decision Criteria

(1) Data from point counts were included in the eagle fatality model runs if the 800-meter circle overlapped turbines or if the circle occurred within 1 kilometer (km) of at least one turbine.

Rationale: This approach assumes that at a distance of 1 km, there is a close association between the sampling sites and the turbine locations such as a similarity of habitat types and/or eagle use (ECPG 2013, p. 57).

Exception to Criterion #1: Data from point counts along the eastern side of the "interior rim" of Chokecherry were excluded from the analysis even though turbines occurred within 1 km of the 800-meter circle.

Rationale: Data from point counts can be excluded if topographic features and vegetation types are not representative of the project footprint.

Exception to Criterion #1: Data from point counts on the periphery of the project footprint could be excluded if: (a) spatial coverage approached 30 percent, (b) turbines did not overlap the 800-meter circle, and (c) removing data from these point counts did not create a gap in spatial coverage.

Rationale: Eagle activity on the periphery of the project may be substantially different than within the project footprint; therefore, data from points on the periphery might not reflect project-related risk to eagles. However, without other data, points on the periphery may represent the best available information about risk to eagles and should be included.

Data from points on the periphery should only be considered for exclusion if: (a) removing the points does not substantially reduce spatial coverage from 30 percent, (b) turbines do not overlap the 800-meter circle (otherwise there is a direct relationship between turbines and eagle use within the point count); and (3) removing the points does not leave a gap in spatial coverage and data from adjacent points are representative of conditions on the periphery of the project footprint.

(2) If data from the point counts in criterion #1 provided less than 30 percent spatial coverage of the project footprint, point counts farther than 1 km were also included in the analysis if the point counts were representative of conditions within the project footprint.

Rationale: The sampling design should provide a minimum spatial coverage of at least 30 percent of the project footprint (ECPG 2013, p. 54). When available eagle use data from point counts did not meet the minimum recommendations from the ECPG, adding data from nearby point counts can be used to compensate for the lack of data, provided the points are representative of topographic features and vegetation types that characterize turbine strings within the project footprint.

Chokecherry-Specific Modifications to Decision Criteria

(See Figures 1 through 4 in Appendix A)

(A) Points RM5 and RM11 (April 2011 to March 2012) and RM21 (Summer 2012) occur along the "interior rim" and data from these points were removed from Phase 1 eagle fatality estimates for the following reasons:

(a1) **RM 5** is along eastern side of the "interior rim," away from Phase 1 development. No turbines occur within the point count or within 1 km of the 800-meter circle around RM5. While data from RM5 could be included due to less than 30 percent spatial coverage (criterion #2), the eastern face of the "interior rim" is a unique topographic feature that is not representative of the project footprint; therefore, data from RM5 were excluded.

(a2) **RM11** One turbine is located within 1 km of the 800-meter circle; therefore, data from RM11 could be included due to criterion #1; however, RM 11 is located along the eastern cliff face of the "interior rim," away from Phase 1 development. Furthermore, almost all eagle observations within the 800-meter point count occur along the eastern face of the rim, and the majority of eagle observations occur outside of Phase 1 development. Data from RM11 were excluded because the topographic feature and pattern of eagle use are not representative of the project footprint.

(a3) **RM21** was a long-watch site during May to July 2012 and replaced the points along the "interior rim" (RM5, RM6 and RM11). Five turbines occur within 1-km of the 800-meter point count, so data from RM21 could be included due to criterion #2. However, data from RM21 were excluded because the point count is located on the eastern face of a unique topographic feature and most eagle movements along the "interior rim" were north-south and did not overlap Phase 1. Data from RM21 were excluded because the topographic feature and pattern of eagle use are not representative of the project footprint.

(B) RM 6 occurs along the western side of the "interior rim" nearest Phase 1. Even though RM6 is on the periphery of the project footprint and all eagle observations from this point count occur within the PCW avoidance area, data from RM6 were included because spatial coverage was considerably less than 30 percent and because two turbines occur within the 800-meter point count and 8 turbines are within 1 km of the circle (criterion #1).

(C) Data from RM12, CC8 and CC13 (the points are located in the SW corner of Chokecherry near Sheep Mountain) were included in the initial model runs, because turbines occur within 1 km of the 800-meter point count circles (criterion #1). In addition, kernel density analysis of the 2011 to 2012 data identified the SW corner of Chokecherry (near RM12) as a "high eagle use" area. In the current project layout, PCW removed turbines from the SW corner of Chokecherry. Because RM12, CC8 and CC13 are now on the periphery of the project footprint, they were considered for exclusion.

(c1) Data from **RM12** were included in the survey period from April 2011 to March 2012, because spatial coverage during this time was considerably less than 30 percent and because removing these data would leave only two point counts to represent eagle use for 202 turbines.

(c2) Data from **RM12** were included in the data from summer of 2012 (May to July), because spatial coverage was considerably less than 30 percent and because removing these data would leave only one point count to represent eagle use for 202 turbines.

(c3) Data from **CC8** (Aug to Nov 2012) were removed from analysis because there are eight other points in Chokecherry during this period and two survey points (CC2 and CC5) provide data for turbines near CC8.

(c4) Data from **CC13** and **RM12** (Dec 2012 to Aug 2013) were removed from analysis, because there are eleven other points in Chokecherry during this period and data from two survey points (CC2 and CC5) provide coverage for nearby turbines.

Sierra Madre-Specific Modifications to Decision Criteria

(See Figures 5 through 8 in Appendix A)

(A) Even though turbines are more than 1 km from **RM15**, data from this point were included in the period from April 2011 to March 2012, because spatial coverage during this period was considerably less than 30 percent and the habitat and features at RM15 are similar to those in the project footprint (criterion #2).

There are only four point count locations in Sierra Madre during April 2011 to March 2012, and only two of those points are on the eastern side of Miller Hill. Including data from RM15 adds a third point to the eastern side of Miller Hill and a fifth survey point to Sierra Madre, which has 298 turbines. Two turbines are within 1.25 km of RM15, and the vegetation and habitat are similar between RM15 and the eastern side of Sierra Madre.

Data from RM15 were not included in the survey periods between November 2012 and August 2013, because there are 18 other points in Sierra Madre during this time and spatial coverage approached 30 percent.

(B) PG6 is located outside of the project footprint, east of the county road. Five turbines occur within 1 km of the 800-meter point count, so data from PG6 are included due to criterion #1. Because the point is on the eastern fringe of Phase 1, data from PG6 could be considered for exclusion, but doing so would substantially reduce the spatial coverage in the northeast portion of Sierra Madre and leave numerous turbines without nearby point count data. In addition, one of the largest and densest white-tailed prairie dog (WTPD) colonies in Sierra Madre occurs west of PG6; therefore, data from PG6 likely characterizes eagle use of the prey resource during the WTPD active period (about April through September).

(C) PG3 is outside of the project footprint on the north side of Miller Hill, and only one turbine occurs near the edge of the 1 km buffer of the 800-meter point count; therefore, data from this point count were considered for exclusion. Four of the habitat types in and around PG3 (Open Water, Aspen-Mixed Conifer, and Montane Shrubland) are not representative of the project footprint. Other nearby points (PG10, PG6, and PG9) contain representative habitat types, and these points provide good spatial coverage of turbine locations; therefore data from PG3 were removed from the analysis.

Appendix B summarizes point count locations by survey period and phase of development.

CALCULATING EAGLE MINUTES FOR THE FATALITY MODEL

April 2011 to March 2012

In June of 2012, the Power Company of Wyoming (PCW) provided a summary spreadsheet of survey effort and eagle observations from the 15 long-watch raptor count locations that were surveyed between April 2011 and March 2012. The dataset included eagle observations out to 6.4 km (4.0 miles), but eagle observations from the long-watch data were truncated at 800-meters due to concerns about detectability falling below assumed 100% beyond 800-meters and to be consistent with survey recommendations in the ECPG (ECPG 2013, pp. 54-59). The truncated dataset (i.e., at 800-meters) for both Phase 1 and Phase 2 included 729 golden eagle minutes, 73 bald eagle minutes and 3 unidentified eagle minutes. Total survey effort included 129,750 minutes or 2,163 hours of observation. These same data were also used in PCW's draft Eagle Conservation Plan and in numerous reports from PCW.

In comparing eagle minutes in the summary spreadsheet with detailed eagle observations in the GIS data file (Raptors201104_201203), it became apparent that the summary spreadsheet had substantially more eagle minutes within 800-meters than could be accounted for in the GIS data. The GIS file included start and end times for each eagle observation, so minutes for each eagle observation could be directly calculated from the GIS file. In contrast, the summary spreadsheet only contained a single column for eagle minutes without any record of how minutes were derived. Upon further review, it was determined that the summary spreadsheet ascribed minutes from the entire flight path to each point in the path instead of just the time for that segment of the flight path. In addition, eagle minutes outside the 800-meter point count were included in the spreadsheet if part of the flight path crossed the point count.

Because the GIS file represents the best available data and because the results from the GIS file can be repeated, the summary spreadsheet and the associated data were not used in the analysis to predict eagle fatalities.

The start and end times in the GIS file were recorded in hours and minutes but did not include seconds (e.g., 08:01 to 08:02 a.m.). Recommendations in the ECPG include rounding time of each eagle observation to "the next highest integer (e.g., an eagle observed flying within the plot for about 15 seconds is 1 eagle minute, another observed within for about 1 minute 10 seconds is 2 eagle-minutes, and so on…)" (ECPG 2013, p. 56). Because seconds were not provided, the number of eagle minutes was rounded to include all minutes in which the eagles were observed. In the above example, the observation occurred at both 08:01 and 08:02, resulting in a total of two eagle minutes. In some cases, this method may inflate the number of eagle minutes, but it ensures the number of eagle minutes is not underestimated. Using this method, the dataset from the GIS file includes 198 golden eagle, 39 bald eagle, and 0 unidentified eagle minutes for Phase 1 (Table 1; GOEA Minutes; BAEA Minutes).

In GIS, eagle observations with corresponding flight paths for Phase 1 were reviewed point by point. Using best professional judgment, eagle minutes were reduced if the eagle flew out of the 800-meter point count. For example, if a three-minute observation of an eagle started at the edge of the point count (i.e., at 800-meters) and the eagle flew away from the circle, that three-minute observation became one eagle minute. This analysis reduced golden eagle minutes for Phase 1 from 198 to 189 minutes and bald eagle from 39 to 34 minutes (Table 1; Flight Adjusted).

The ECPG recommends eagle minutes be "recorded as ≤ 200 m (at or below conservative approximation of maximum height of blade tip of tallest turbine) or > 200 m" (ECPG 2013, p. 56). In the GIS file, heights of eagle observations were recorded as above or below150 meters, therefore, it is impossible to know whether an eagle minute recorded as 150+ meters was between 150 and 200 meters or above 200 meters. To address this issue, all eagle minutes with heights greater than 150 meters were removed. This adjustment reduced golden eagle minutes for Phase 1 from 189 to 145 minutes and bald eagle minutes from 34 to 32 minutes (Table 1; Height Adjusted). Because flight heights were truncated at 150 meters, the prior for exposure in the model was modified to account for sampling volume and the sampled volume term in the model code was adjusted from 200 to 150 meters.

Table 1. Summary of raw, flight-adjusted, and height-adjusted golden eagle (GOEA; orange color) and bald eagle (BAEA; blue color) minutes for Chokecherry (CC) and Sierra Madre (SM) Phase1, based on data from the GIS file.

Phase / Location	GOEA Minutes	Flight Adjusted	Height Adjusted	BAEA Minutes	Flight Adjusted	Height Adjusted
CC Phase 1	50	50	37	13	10	10
SM Phase 1	148	139	108	26	24	22
Total	198	189	**145**	39	34	**32**

May 2012 to August 2013

For five survey periods between May 2012 and August 2013, the PCW provided spreadsheets containing detailed descriptions of eagle observations within the 800-meter point counts, including start and end times for each eagle observation. Start and end times were recorded in hours and minutes but did not include seconds (e.g., 10:05 to 10:07 a.m.). Recommendations in the ECPG include rounding time of each eagle observation to "the next highest integer" (ECPG 2013, p. 56). Similar to treatment of the earlier GIS data, the number of eagle minutes was rounded to include all minutes in which the eagles were observed. In the above example, the observation occurred in 10:05, 10:06 and 10:07, resulting in a total of three eagle minutes. In some cases, this method may inflate the number of eagle minutes, but it ensures the number of eagle minutes is not underestimated.

For the Summer 2012 dataset and a portion of the Fall 2012 dataset, eagle minutes were recorded as above or below 150 meters instead of 200 meters as recommended (ECPG 2013, p. 56). To address this issue, all eagle minutes with heights greater than 150 meters were removed, and then sampled volume in the model code was adjusted from 200 to 150 meters. For the second half of the Fall 2012 dataset, and the Winter 2012, Spring 2013 and Summer 2013 datasets, eagle observations were recorded as above or below 200 meters.

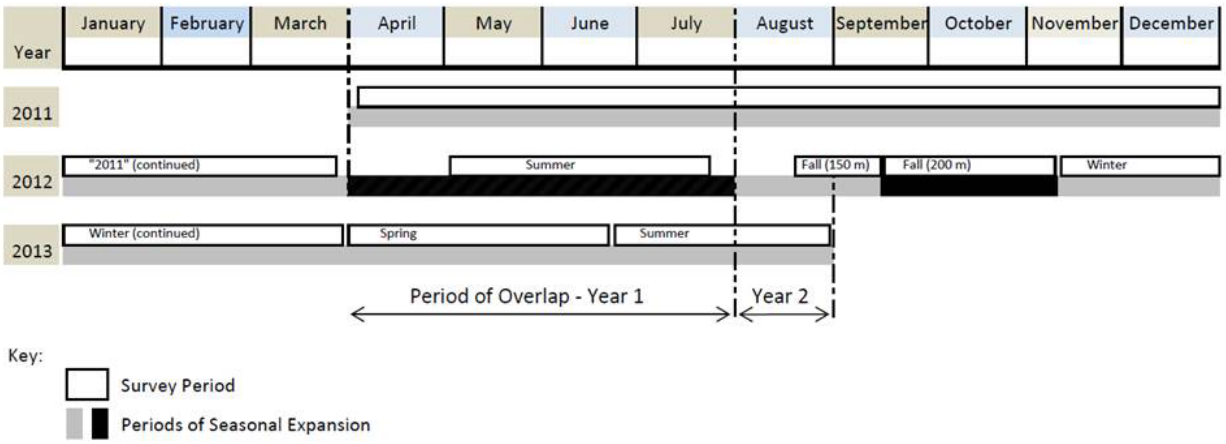
Periods of Sampling Overlap for "Year1" and "Year2"

Data from the first year (April 2011 to March 2012) and data from the summer of 2012 (May 2012 to July 2012) were collected using the same methods. Even though the number and location of points differed, the data from the 16 months can be combined into one year (Year1) for use in the model, because the data were collected using similar methods. Data from the 16 months of "Year 1" were pooled and used to predict fatalities for one 12-month year (Figure 1).

The second year of data (August 2012 to August 2013) was collected over thirteen months from different numbers of survey points (i.e., 40 and 60) and using different eagle flight heights (i.e., 150 and 200 meters). Because of the varying survey effort and different volumes, the data were stratified by sampling methodology. The sampling periods from Year2 are "Fall2012-150m" (40 points, 150 meters), "Fall2012-200m" (40 points, 200 meters) and "Winter2012 / Spring2013 / Summer2013" (60 points, 200 meters).

Data from the 13 months of "Year2" were pooled and used to predict fatalities for one 12-month year; however, the code in the eagle fatality model was modified to account for different survey volumes and hazardous area volumes (Figure 1).

Figure 1. Survey effort (and period of expansion) overlapped from April 2011 through July 2012 (collectively "Year 1") and from August 2012 to August 2013(collectively "Year 2").



Appendix C summarizes survey effort and eagle minutes for individual survey points during each survey period.

Appendix D summarizes total survey effort and eagle minutes for Chokecherry and Sierra Madre during each survey period based on the decision criteria whether to include or exclude survey points.

ADJUSTMENTS DUE TO AVOIDANCE AREAS

In general, eagle minutes observed at observation points that overlapped the PCW-avoidance areas were not subtracted from the model runs by USFWS. The avoidance areas are primarily a concern for the April 2011 to March 2012 dataset, because later point count locations were placed outside of the avoidance areas. Earlier attempts by USFWS and PCW to exclude eagle minutes that occurred within the avoidance areas were based on data from the summary spreadsheet (rather than GIS data), and resulted in removal of between 40 to 75 percent of eagle minutes depending on method used.

Using data from the GIS file (instead of the summary spreadsheet) for those points included in the decision criteria results in the removal of a small percentage of eagle minutes from Phase 1 survey points. One possible reason to exclude data within the avoidance areas is that they are

areas where turbines will not be built and so risk to eagles should be lower; however, in most cases there are not enough eagle observations to conclude that eagle activity differs between areas within an 800-meter survey point. Furthermore, removing eagle minutes within the avoidance areas may result in a higher eagle fatality estimate due to the corresponding subtraction of survey area within the avoidance areas.

RM5, RM11, and RM21 occur within the avoidance areas. As discussed earlier, eagle minutes from RM5, RM11, and RM21 were not included, because the points occur along the eastern face of the "interior rim," a unique topographic feature that does not represent the project footprint. In addition, most eagle movements occur within the avoidance areas. All eagle minutes from RM5, RM11, and RM21 are excluded from the model.

ADJUSTMENTS TO ANNUAL DAYLIGHT HOURS

Based on the location of Teton Reservoir, which is about halfway between Chokecherry and Sierra Madre, the daylight hour function (author: M. Otto, USFWS) calculated 4,458 daylight hours on an annual basis (Appendix E). Using turbine-specific information, the percent of daylight operational periods for each of the 500 turbines ranges from 70 to 98 percent, with an annual average of 91.9 percent for all 500 turbines combined (AWS Truepower 2014). Operational hours for each turbine were provided by season; therefore, seasonal averages for Chokecherry range from 88.4 to 96.3 percent and from 85.1 to 94.5 percent for Sierra Madre (Appendix E).

Based on a project-wide average of an eight percent non-operational period, and based on the seasonal curtailment of 17 turbines near nest "162" for 89.25 days between 1 February and 30 April, the annual daylight hours were adjusted from 4,458 to 4,064 daylight hours per year (Appendix E).

Fatality estimates were also run separately for Phase 1 of Chokecherry and Phase 1 of Sierra Madre. Because there is no pre-planned curtailment within Chokecherry, the adjusted daylight hours (4,149.6) are based on the average season operational hours of turbines only within Chokecherry (Appendix E).

At Sierra Madre, 17 turbines near nest "162" will be curtailed during all daylight hours for 89.25 days between February 1st and April 30th. Subtracting the turbine-hours for the 17 turbines during the curtailment period, and using the average seasonal operational hours for the 298 turbines within Sierra Madre, there are 4,005 daylight hours per year (Appendix E).

VOLUME ADJUSTMENTS

The volume of the observed area in the model (the 200-meter high cylinder around each turbine) was adjusted for the April 2011 to March 2012 dataset, the Summer 2012 dataset (05/01/12 - 07/24/12) and part of the fall 2012 dataset (08/20/12 - 09/15/12), because eagle observations were recorded as above or below 150 meters rather than 200 meters recommended in the ECPG.

The eagle fatality model code was modified to compute the exposure prior and posterior and hazardous area in the expansion factor as volumes since some of the data collection did not use the recommended 200-m and below. These changes are indicated in the model code used in the USFWS analysis.

MODEL INPUTS AND RESULTS

Appendix F summarizes the data used as inputs into the eagle fatality model as well as the model results. Individual estimates of golden eagle fatalities and bald eagle fatalities were also run separately for Phase 1 of Chokecherry and Phase 1 of Sierra Madre. Fatalities for each species were predicted using turbines with 103-meter diameter blades and 120-meter diameter blades.

Due to similarity of data collection methods, the data from Year1 (April 2011 to July 2012) were combined into one model run for Chokecherry and one model run for Sierra Madre. Because the eagle fatality model uses a Bayesian framework, the posterior from Year1 informs Year2 as the new prior. Because the second "year" (Year2, August 2012 to August 2013) was collected over thirteen months using different methods, data from the Year2 were pooled and used to predict fatalities for one 12-month year (see prior discussion).

In the Bayesian framework, results from Year2 are actually a combination of the data from both Year1 and Year2. Therefore, while results are shown for Year1 in Appendix F, the results from Year2 are the "final" predicted eagle fatalities.

Using the largest on-shore turbine anticipated (120-meter diameter blade), the 80 percent upper credible interval (80% UCI) from the USFWS peer-reviewed model predicts 14 golden eagle fatalities and 2 bald eagle fatalities annually for Phase 1 of the Chokecherry and Sierra Madre Wind Energy Project. Using a smaller turbine (103-meter blade), the 80% UCI from the model predicts the 500 turbines of Phase 1 will result in 10 golden eagle and 1.4 bald eagle fatalities annually (7 bald eagles every 5 years).

The average (mean) fatality estimates are also provided in Appendix F; however, the Eagle Conservation Plan Guidance recommends using a risk-averse method such as the 80% UCI for calculating programmatic eagle take, rather than using the average (ECPG 2013, p. 29). However, the average number of predicted fatalities is 7 and 10 golden eagles and 1 and 2 bald eagles for 103-meter and 120-meter blades, respectively.

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Appendix A: Maps of Point Count Locations

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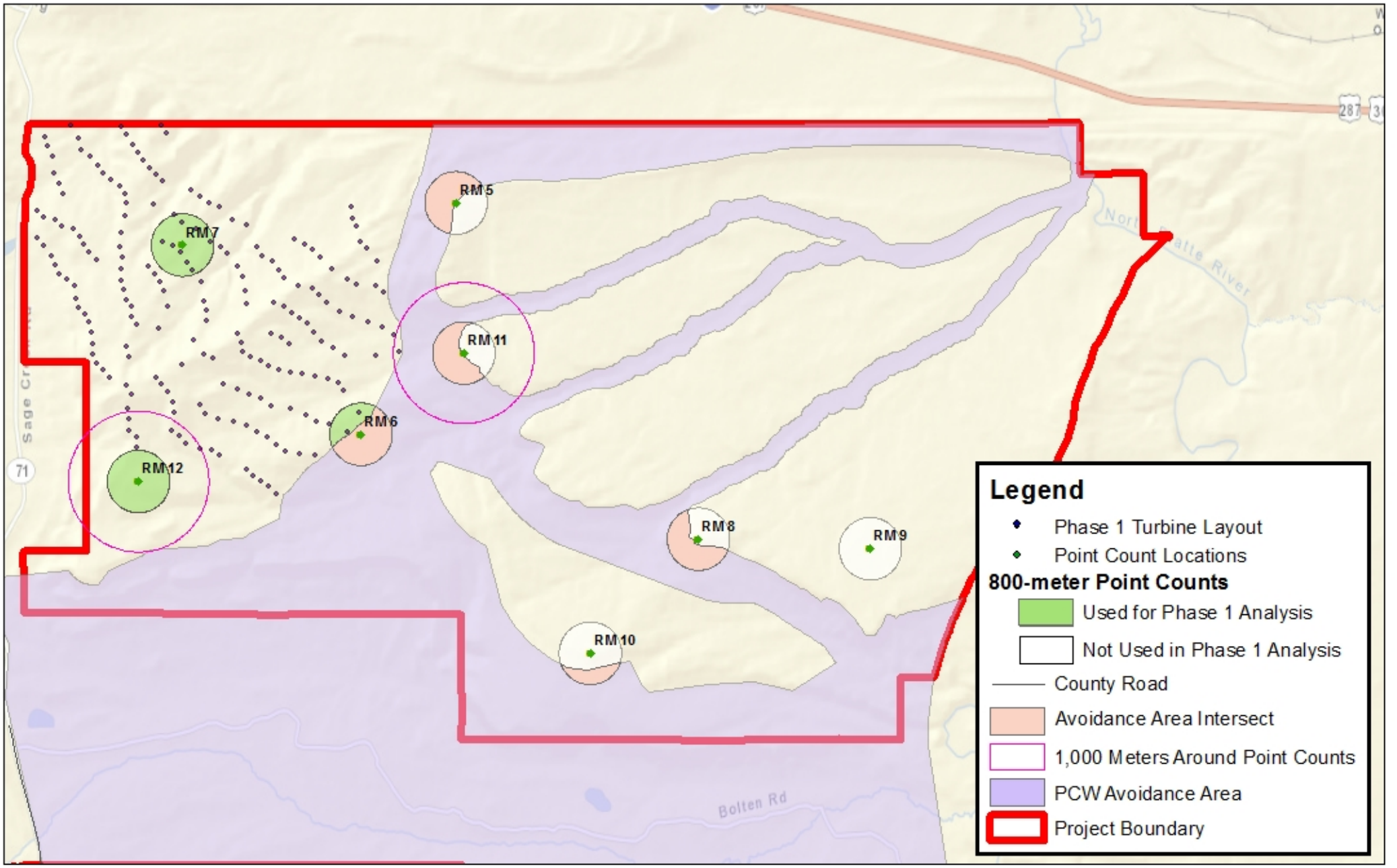
Figure 1. Chokecherry Survey Locations, April 2011 through March 2012



Created By: USFWS, Wyoming ES
Map Date: 5/9/2014
Source: ESRI | SWCA | PCW | FWS | BLM

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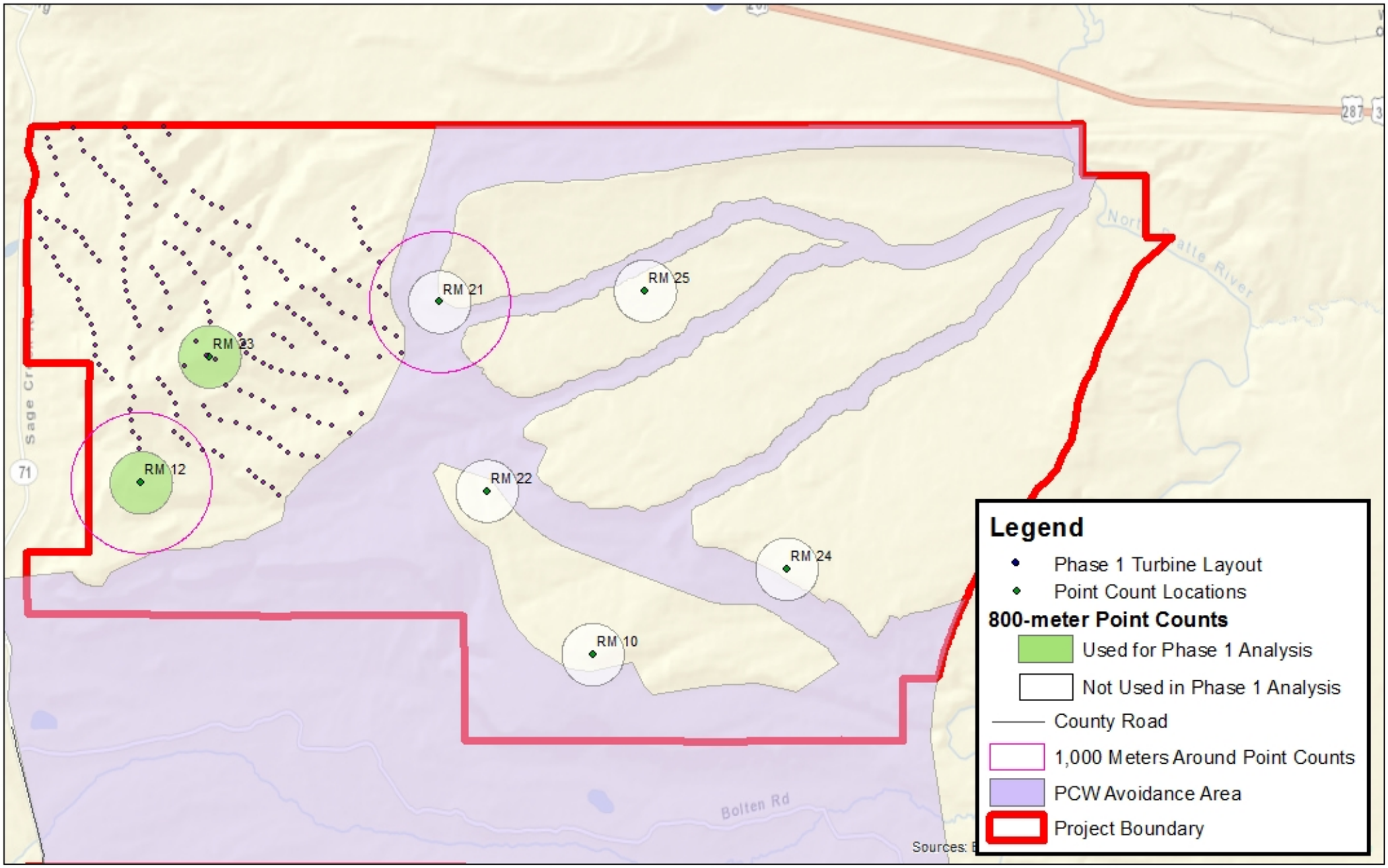
Figure 2. Chokecherry Survey Locations, May 2012 through July 2012

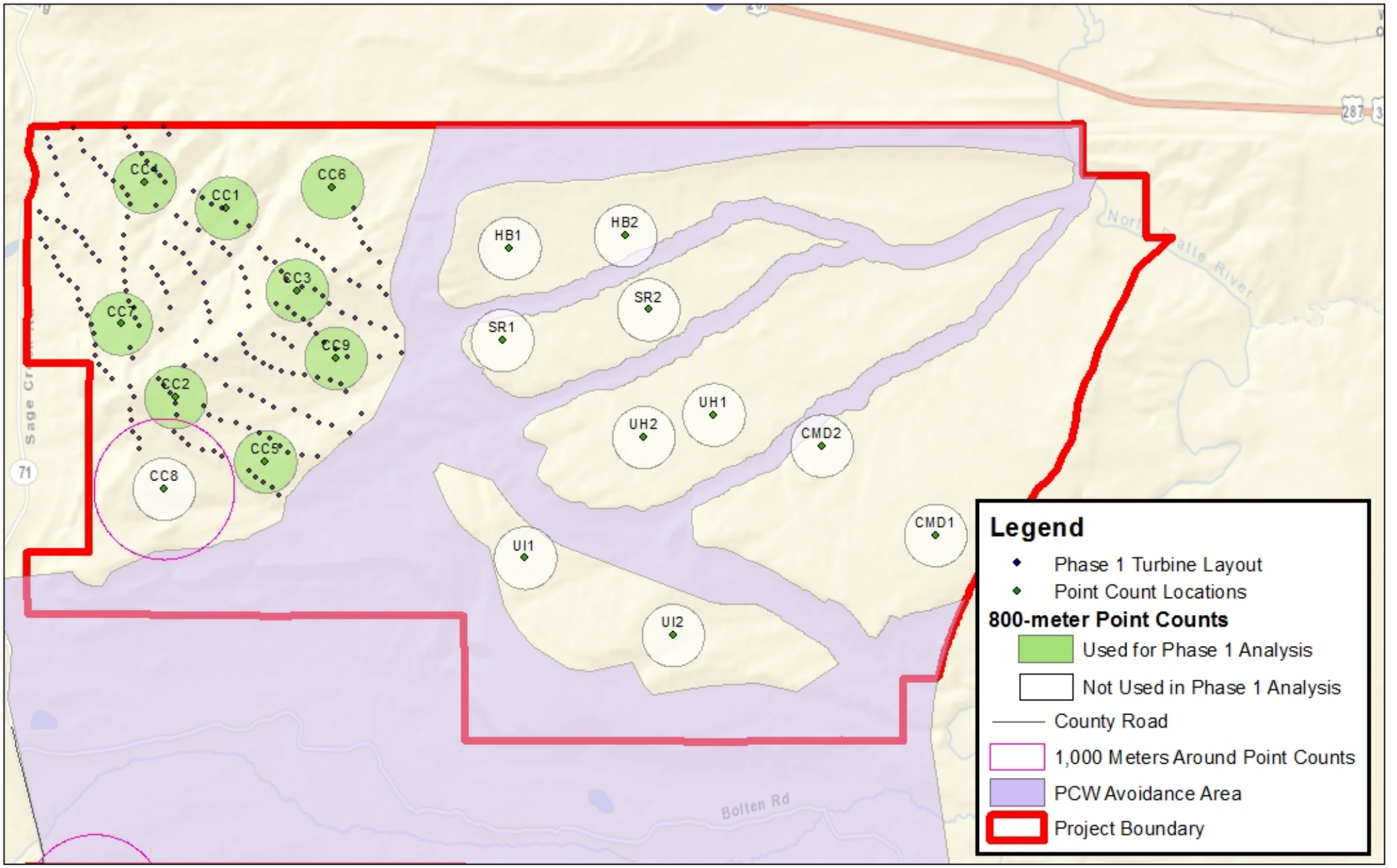


Created By: USFWS, Wyoming ES
Map Date: 5/9/2014
Source: ESRI | SWCA | PCW | FWS | BLM

0 1.5 3 4.5 6 Miles

N

Figure 3. Chokecherry Survey Locations, August through November 2012

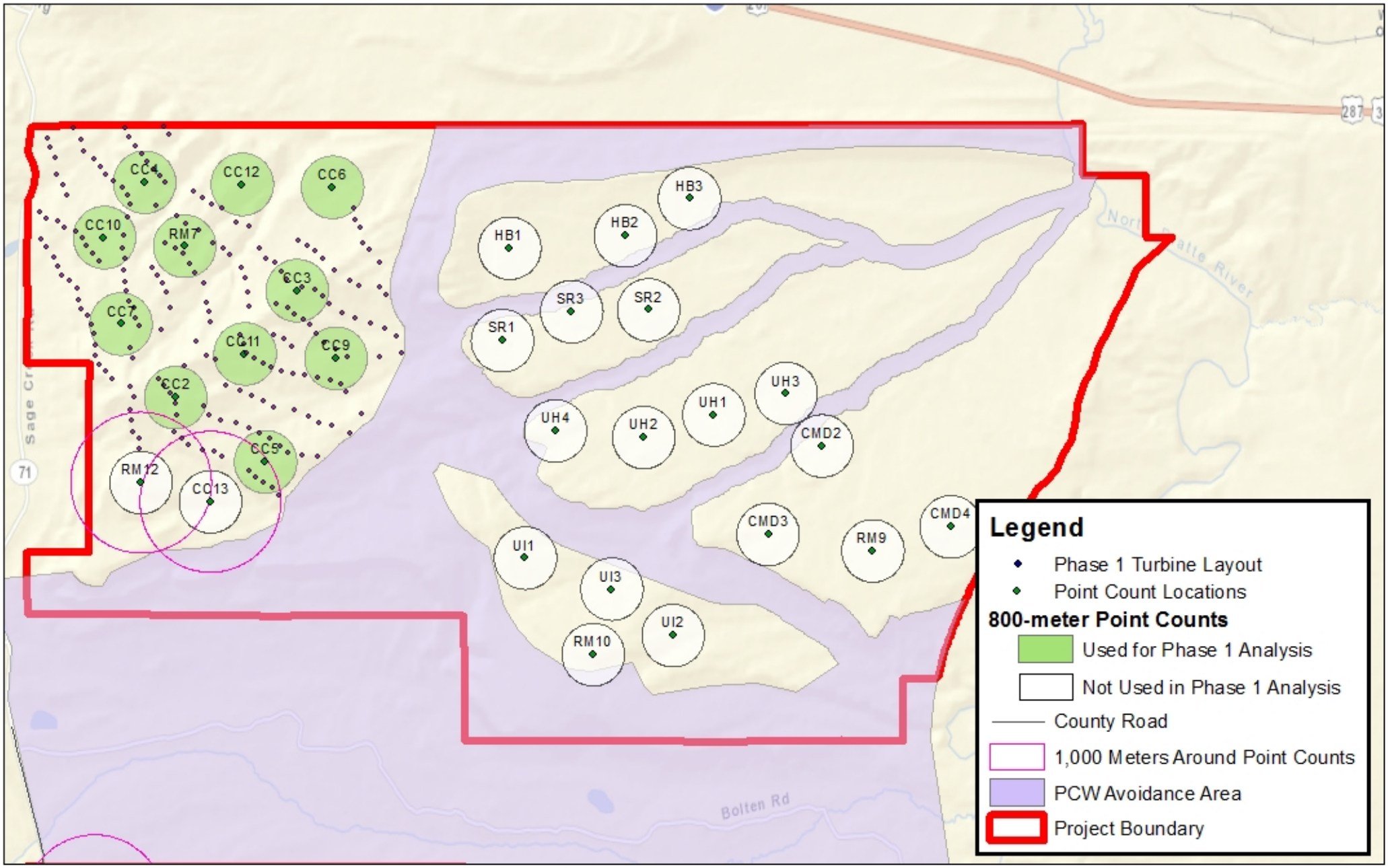


Created By: USFWS, Wyoming ES
Map Date: 5/9/2014
Source: ESRI | SWCA | PCW | FWS | BLM

0 1.5 3 4.5 6 Miles

N

Figure 4. Chokecherry Survey Locations, November 2012 through August 2013



Created By: USFWS, Wyoming ES
Map Date: 5/9/2014
Source: ESRI | SWCA | PCW | FWS | BLM

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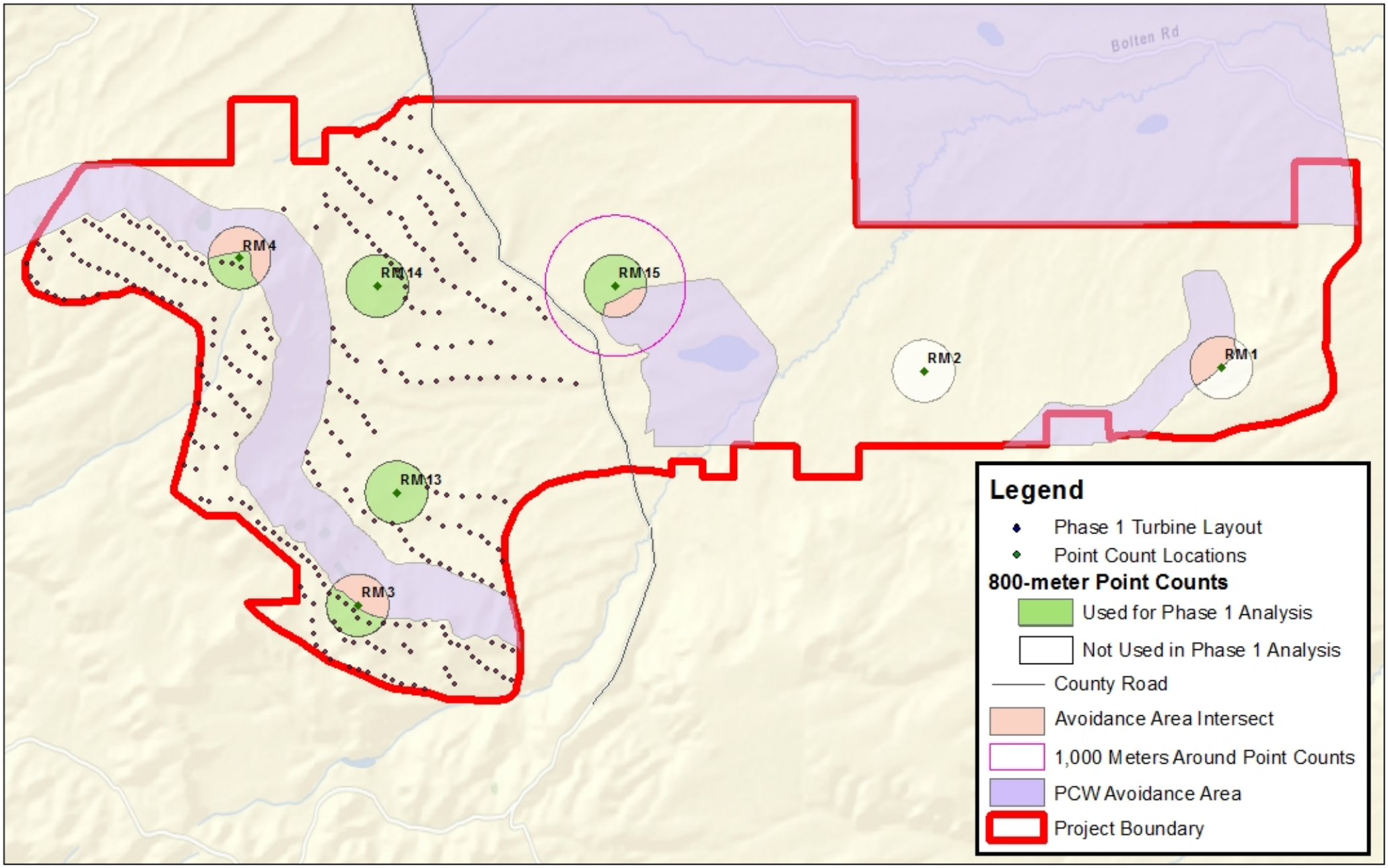
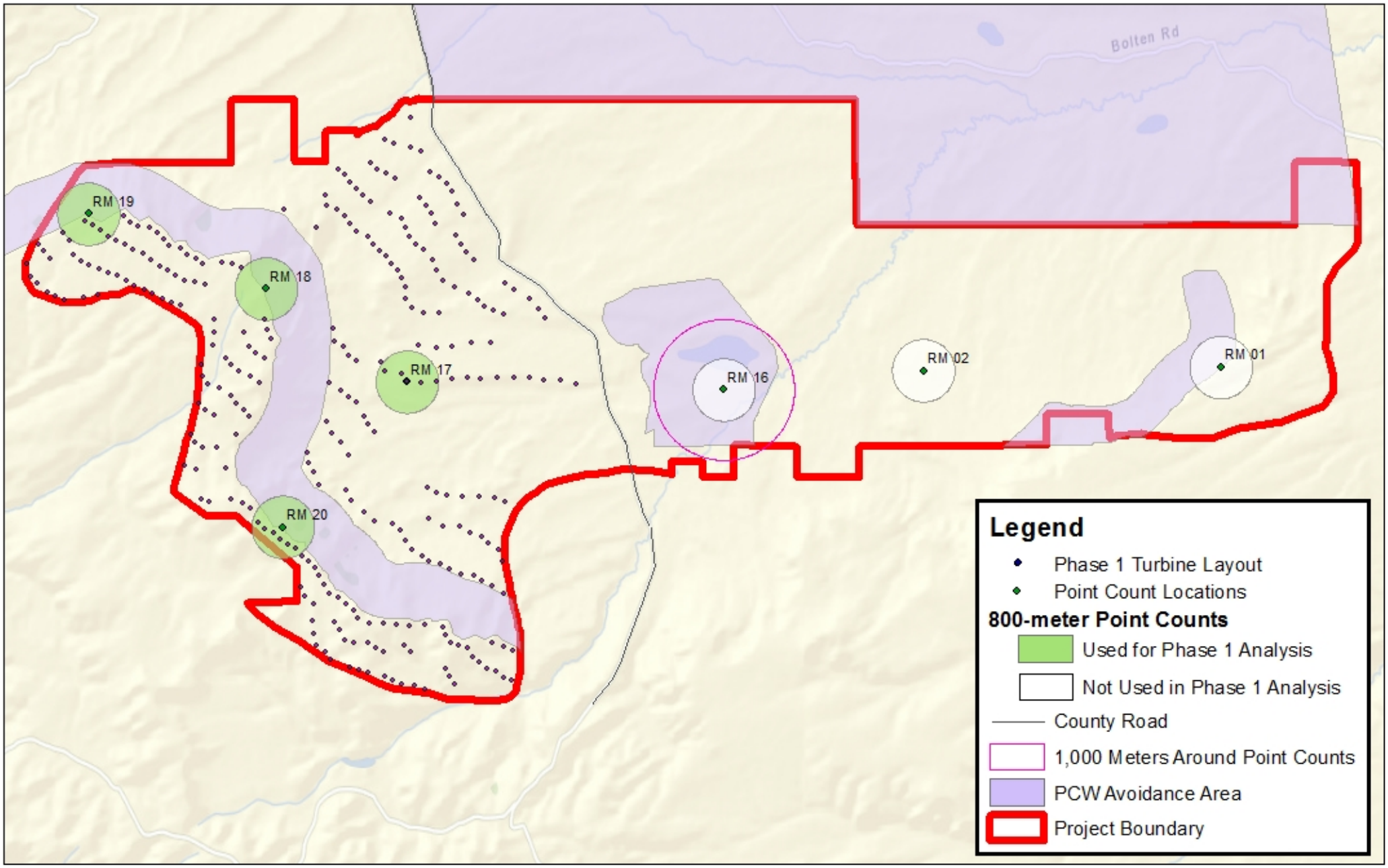
Figure 5. Sierra Madre Survey Locations, April 2011 through March 2012



Created By: USFWS, Wyoming ES
Map Date: 5/9/2014
Source: ESRI | SWCA | PCW | FWS | BLM

Figure 6. Sierra Madre Survey Locations, May 2012 through July 2012



Created By: USFWS, Wyoming ES
Map Date: 5/9/2014
Source: ESRI | SWCA | PCW | FWS | BLM

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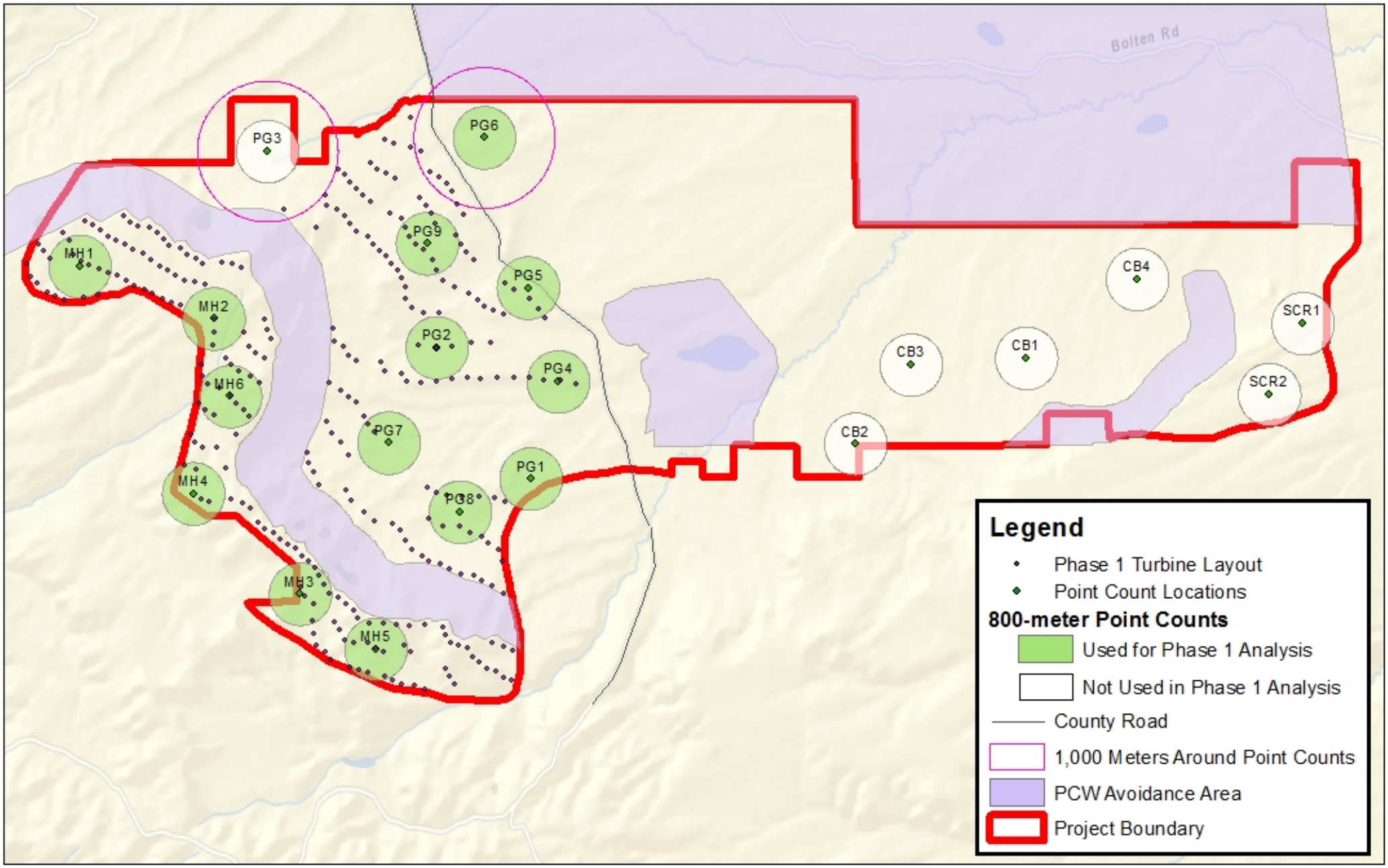
Figure 7. Sierra Madre Survey Locations, August through November 2012

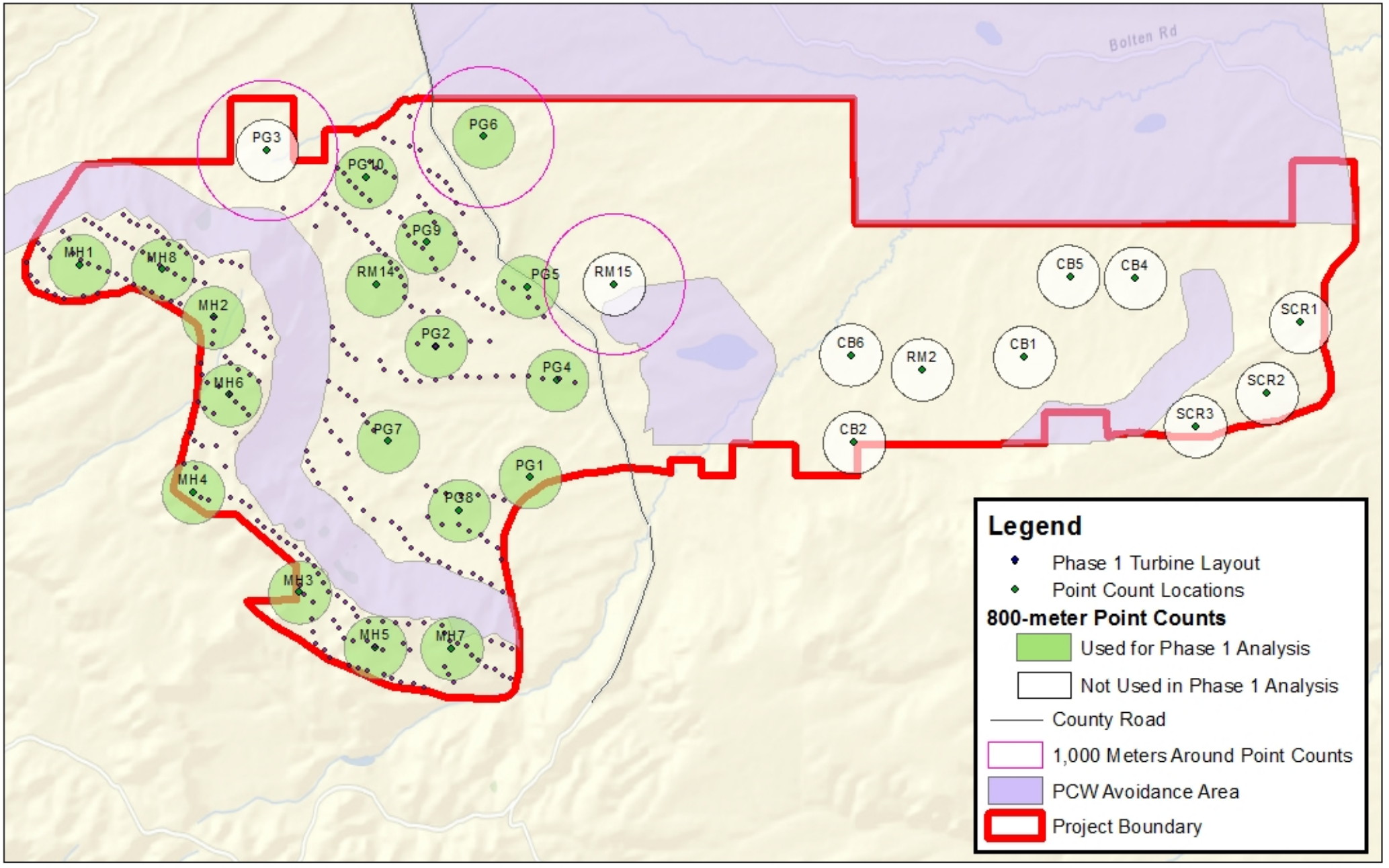


Created By: USFWS, Wyoming ES
Map Date: 5/9/2014
Source: ESRI | SWCA | PCW | FWS | BLM

0 1.5 3 4.5 6 Miles

N

Figure 8. Sierra Madre Survey Locations, November 2012 through August 2013



Created By: USFWS, Wyoming ES
Map Date: 5/9/2014
Source: ESRI | SWCA | PCW | FWS | BLM

0 1.5 3 4.5 6 Miles

N

Appendix B: Summary Table of Point Count Locations in Phase 1 for Each Survey Period

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Geographic Location of Survey Points by Survey Period - Phase 1

15 SURVEY POINTS 04/04/11 - 03/27/12		**14 SURVEY POINTS** 05/01/12 - 07/24/12		**40 SURVEY POINTS** 08/20/12 - 11/09/12		**60 SURVEY POINTS** 11/12/12 - 08/30/13	
PHASE 1		PHASE 1		Phase 1		PHASE 1	
CC	SM	CC	SM	CC	SM	CC	SM
RM6	RM13	RM12	RM17	CC1	MH1	CC10	MH1
RM7	RM14	RM23	RM18	CC2	MH2	CC11	MH2
RM12	RM3		RM19	CC3	MH3	CC12	MH3
	RM4		RM20	CC4	MH4	CC13	MH4
	RM15			CC5	MH5	CC2	MH5
				CC6	MH6	CC3	MH6
				CC7	PG1	CC4	MH7
				CC8	PG2	CC5	MH8
				CC9	PG3	CC6	PG1
					PG4	CC7	PG10
					PG5	CC9	PG2
					PG6	RM12	PG3
					PG7	RM7	PG4
					PG8		PG5
					PG9		PG6
							PG7
							PG8
							PG9
							RM14
3	5	2	4	9	15	13	19

In this period, data from RM15 are included in Sierra Madre Phase 1

Data from CC8, CC13 and RM12 excluded from Chokecherry Phase 1 starting Fall 2012

Data from PG3 excluded from Sierra Madre starting Fall 2012

Appendix C: Eagle Minutes and Survey Effort by Survey Point and Sampling Period

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Survey Data by Point Count by Survey Period

** GOEA = Golden Eagle; BAEA = Bald Eagle; Obs = Observation
** Eagle minutes are rounded up.
** Eagle observations recorded as 150+ meters are not included.
** Fall 2012 data are split at 9/16 due to different methods used to record eagle altitude.

2011 Spring to 2012 Spring Data (04/04/11 - 03/27/12) (<150 meters)

Phase	Survey Point	Minutes GOEA	BAEA	Obs	Area Obs*	Eagle Exposure[1]
CC - West	RM 6	24	5	9041	2.01	0.00132
CC - West	RM 7	0	5	7790	2.01	0.00000
CC - West	RM 12	13		7970	2.01	0.00081
SM - West	RM 3	1	1	7173	2.01	0.00007
SM - West	RM 4	13		8171	2.01	0.00079
SM - West	RM 13	20	4	10563	2.01	0.00094
SM - West	RM 14	50	17	8264	2.01	0.00301
SM - West	*RM 15*	24		8558	2.01	0.00140
SM-East	RM 1	29		8889	2.01	0.00162
SM-East	RM 2	49		8606	2.01	0.00283
CC - East	RM 5	41		8480	2.01	0.00241
CC - East	RM 8	59	1	8913	2.01	0.00329
CC - East	RM 9	9		9290	2.01	0.00048
CC - East	RM 10	4		8729	2.01	0.00023
CC - East	RM 11	101	5	9313	2.01	0.00540

2011 Spring to 2012 Spring
Summary of Minutes by Phase

Phase	GOEA	BAEA	Obs
CC - East	214	6	44,725
CC - West	37	10	24,801
SM - West	108	22	42,729
SM-East	78		17,495
Grand Total	**437**	**38**	**129,750**

2012 Summer Data (05/01/12 - 07/24/12) (eagle minutes <150 meters)

Phase	Survey Point	Minutes GOEA	BAEA	Obs	Area Obs*	Eagle Exposure[1]
CC - West	RM12			1080	2.01	0.00000
CC - West	RM23			1044	2.01	0.00000
SM - West	RM17	5		1082	2.01	0.00230
SM - West	RM18	3		1088	2.01	0.00137
SM - West	RM19	9		1080	2.01	0.00415
SM - West	RM20	2		1080	2.01	0.00092
CC - East	RM10			1080	2.01	0.00000
CC - East	RM21			1080	2.01	0.00000
CC - East	RM22			1082	2.01	0.00000
CC - East	RM24			1080	2.01	0.00000
CC - East	RM25	2		1083	2.01	0.00092
SM-East	RM01	4		1140	2.01	0.00175
SM-East	RM02			1140	2.01	0.00000
SM-East	RM16			1080	2.01	0.00000

2012 Summer Data
Summary of Minutes by Phase

Phase	GOEA	BAEA	Obs
CC - East	2		5,405
CC - West			2,124
SM - West	19		4,330
SM-East	4		3,360
Grand Total	**25**	**0**	**15,219**

2012 Fall Data (in part) (08/20/12 - 09/15/12) (eagle minutes <150 meters)

Phase	Survey Point	Minutes GOEA	Minutes BAEA	Obs	Area Obs*	Eagle Exposure[1]
CC - West	CC1			240	2.01	0.00000
CC - West	CC2			240	2.01	0.00000
CC - West	CC3			240	2.01	0.00000
CC - West	CC4			240	2.01	0.00000
CC - West	CC5			240	2.01	0.00000
CC - West	CC6			240	2.01	0.00000
CC - West	CC7			300	2.01	0.00000
CC - West	CC8	0		240	2.01	0.00000
CC - West	CC9			240	2.01	0.00000
SM - West	MH1	7		240	2.01	0.01451
SM - West	MH2			240	2.01	0.00000
SM - West	MH3			300	2.01	0.00000
SM - West	MH4			240	2.01	0.00000
SM - West	MH5			300	2.01	0.00000
SM - West	MH6			240	2.01	0.00000
SM - West	PG1			240	2.01	0.00000
SM - West	PG2	2		240	2.01	0.00415
SM - West	PG3		2	240	2.01	0.00000
SM - West	PG4			240	2.01	0.00000
SM - West	PG5			300	2.01	0.00000
SM - West	PG6			240	2.01	0.00000
SM - West	PG7			240	2.01	0.00000
SM - West	PG8			240	2.01	0.00000
SM - West	PG9			240	2.01	0.00000
CC - East	CMD1			300	2.01	0.00000
CC - East	CMD2			240	2.01	0.00000
CC - East	HB1			240	2.01	0.00000
CC - East	HB2			240	2.01	0.00000
CC - East	SR1			240	2.01	0.00000
CC - East	SR2			240	2.01	0.00000
CC - East	UH1			300	2.01	0.00000
CC - East	UH2			240	2.01	0.00000
CC - East	UI1			240	2.01	0.00000
CC - East	UI2			240	2.01	0.00000
SM-East	CB1			300	2.01	0.00000
SM-East	CB2			240	2.01	0.00000
SM-East	CB3			240	2.01	0.00000
SM-East	CB4			240	2.01	0.00000
SM-East	SCR1	3		240	2.01	0.00622
SM-East	SCR2	6		240	2.01	0.01244

2012 Fall Data (in part)
Summary of Minutes by Phase

Phase	GOEA	BAEA	Obs
CC - East			2,520
CC - West	0		2,220
SM - West	9	2	3,780
SM-East	9		1,500
Grand Total	**18**	**2**	**10,020**

2012 Fall Data (in part) (09/17/12 - 11/09/12) (eagle minutes <200 meters)

Phase	Survey Point	Minutes GOEA	Minutes BAEA	Obs	Area Obs*	Eagle Exposure[1]
CC - West	CC1			480	2.01	0.00000
CC - West	CC2			480	2.01	0.00000
CC - West	CC3	3		458	2.01	0.00326
CC - West	CC4	6		480	2.01	0.00622
CC - West	CC5			480	2.01	0.00000
CC - West	CC6	4		476	2.01	0.00418
CC - West	CC7			480	2.01	0.00000
CC - West	CC8	0		480	2.01	0.00000
CC - West	CC9			480	2.01	0.00000
SM - West	MH1			480	2.01	0.00000
SM - West	MH2			480	2.01	0.00000
SM - West	MH3			480	2.01	0.00000
SM - West	MH4			480	2.01	0.00000
SM - West	MH5			480	2.01	0.00000
SM - West	MH6	5		480	2.01	0.00518
SM - West	PG1	3		480	2.01	0.00311
SM - West	PG2	2		480	2.01	0.00207
SM - West	PG3			480	2.01	0.00000
SM - West	PG4			600	2.01	0.00000
SM - West	PG5	3		480	2.01	0.00311
SM - West	PG6			360	2.01	0.00000
SM - West	PG7			480	2.01	0.00000
SM - West	PG8			600	2.01	0.00000
SM - West	PG9			360	2.01	0.00000
CC - East	CMD1			480	2.01	0.00000
CC - East	CMD2			480	2.01	0.00000
CC - East	HB1			480	2.01	0.00000
CC - East	HB2			480	2.01	0.00000
CC - East	SR1			480	2.01	0.00000
CC - East	SR2			480	2.01	0.00000
CC - East	UH1			462	2.01	0.00000
CC - East	UH2			480	2.01	0.00000
CC - East	UI1			480	2.01	0.00000
CC - East	UI2			480	2.01	0.00000
SM-East	CB1			480	2.01	0.00000
SM-East	CB2			480	2.01	0.00000
SM-East	CB3			360	2.01	0.00000
SM-East	CB4			600	2.01	0.00000
SM-East	SCR1			480	2.01	0.00000
SM-East	SCR2	9		480	2.01	0.00933

2012 Fall Data (in part)
Summary of Minutes by Phase

Phase	GOEA	BAEA	Obs
CC - East			4,782
CC - West	13		4,294
SM - West	13		7,200
SM-East	9		2,880
Grand Total	**35**	**0**	**19,156**

2012 Winter Data (11/12/12 - 03/29/13) (eagle minutes <200 meters)

Phase	Survey Point	Minutes GOEA	Minutes BAEA	Obs	Area Obs*	Eagle Exposure[1]
CC - West	CC10			540	2.01	0.00000
CC - West	CC11			540	2.01	0.00000
CC - West	CC12			540	2.01	0.00000
CC - West	CC13	14		540	2.01	0.01290
CC - West	CC2			540	2.01	0.00000
CC - West	CC3			510	2.01	0.00000
CC - West	CC4			540	2.01	0.00000
CC - West	CC5			420	2.01	0.00000
CC - West	CC6			480	2.01	0.00000
CC - West	CC7	8		480	2.01	0.00829
CC - West	CC9			480	2.01	0.00000
CC - West	RM12	0		540	2.01	0.00000
CC - West	RM7			540	2.01	0.00000
SM - West	MH1			300	2.01	0.00000
SM - West	MH2			480	2.01	0.00000
SM - West	MH3			480	2.01	0.00000
SM - West	MH4			300	2.01	0.00000
SM - West	MH5			480	2.01	0.00000
SM - West	MH6			540	2.01	0.00000
SM - West	MH7			480	2.01	0.00000
SM - West	MH8	3		540	2.01	0.00276
SM - West	PG1			540	2.01	0.00000
SM - West	PG10			540	2.01	0.00000
SM - West	PG5			540	2.01	0.00000
SM - West	PG2			540	2.01	0.00000
SM - West	PG3	12		540	2.01	0.01106
SM - West	PG4	7		540	2.01	0.00645
SM - West	PG6	3		540	2.01	0.00276
SM - West	PG7			480	2.01	0.00000
SM - West	PG8			480	2.01	0.00000
SM - West	PG9			480	2.01	0.00000
SM - West	RM14	9		480	2.01	0.00933
CC - East	CMD2			480	2.01	0.00000
CC - East	CMD3			400	2.01	0.00000
CC - East	CMD4			540	2.01	0.00000
CC - East	HB1			600	2.01	0.00000
CC - East	HB2			540	2.01	0.00000
CC - East	HB3	4		480	2.01	0.00415
CC - East	RM10			540	2.01	0.00000
CC - East	RM9			480	2.01	0.00000
CC - East	SR1	6		540	2.01	0.00553
CC - East	SR2			540	2.01	0.00000
CC - East	SR3			540	2.01	0.00000

2012 Winter Data
Summary of Minutes by Phase

Phase	GOEA	BAEA	Obs
CC - East	20		9,313
CC - West	22		6,690
SM - West	34		9,300
SM-East	32		5,220
Grand Total	**108**	**0**	**30,523**

CC - East	UH1		513	2.01	0.00000
CC - East	UH2		600	2.01	0.00000
CC - East	UH3		540	2.01	0.00000
CC - East	UH4	2	480	2.01	0.00207
CC - East	UI1	2	420	2.01	0.00237
CC - East	UI2	6	600	2.01	0.00498
CC - East	UI3		480	2.01	0.00000
SM-East	CB1	7	540	2.01	0.00645
SM-East	CB2		420	2.01	0.00000
SM-East	CB4	5	540	2.01	0.00461
SM-East	CB5		540	2.01	0.00000
SM-East	CB6	8	480	2.01	0.00829
SM-East	RM15	12	600	2.01	0.00995
SM-East	RM2		540	2.01	0.00000
SM-East	SCR1		540	2.01	0.00000
SM-East	SCR2		480	2.01	0.00000
SM-East	SCR3		540	2.01	0.00000

2013 Spring Data (04/01/13 - 06/21/13) (eagle minutes <200 meters)

Phase	Survey Point	Minutes GOEA	Minutes BAEA	Obs	Area Obs*	Eagle Exposure[1]
CC - West	CC10			360	2.01	0.00000
CC - West	CC11			360	2.01	0.00000
CC - West	CC12			300	2.01	0.00000
CC - West	CC13	0		300	2.01	0.00000
CC - West	CC2			360	2.01	0.00000
CC - West	CC3	2		360	2.01	0.00276
CC - West	CC4			300	2.01	0.00000
CC - West	CC5			300	2.01	0.00000
CC - West	CC6			300	2.01	0.00000
CC - West	CC7			360	2.01	0.00000
CC - West	CC9			360	2.01	0.00000
CC - West	RM12	0		300	2.01	0.00000
CC - West	RM7			300	2.01	0.00000
SM - West	MH1			360	2.01	0.00000
SM - West	MH2			360	2.01	0.00000
SM - West	MH3			360	2.01	0.00000
SM - West	MH4			300	2.01	0.00000
SM - West	MH5			300	2.01	0.00000
SM - West	MH6			360	2.01	0.00000
SM - West	MH7			360	2.01	0.00000
SM - West	MH8			300	2.01	0.00000
SM - West	PG1			360	2.01	0.00000
SM - West	PG10			300	2.01	0.00000
SM - West	PG5			360	2.01	0.00000

2013 Spring Data
Summary of Minutes by Phase

Phase	GOEA	BAEA	Obs
CC - East			5,940
CC - West	2		4,260
SM - West	1		6,360
SM-East	4		3,314
Grand Total	**7**	**0**	**19,874**

SM - West	PG2		300	2.01	0.00000
SM - West	PG3		360	2.01	0.00000
SM - West	PG4		360	2.01	0.00000
SM - West	PG6		300	2.01	0.00000
SM - West	PG7		360	2.01	0.00000
SM - West	PG8		300	2.01	0.00000
SM - West	PG9		300	2.01	0.00000
SM - West	RM14	1	360	2.01	0.00138
CC - East	CMD2		360	2.01	0.00000
CC - East	CMD3		360	2.01	0.00000
CC - East	CMD4		360	2.01	0.00000
CC - East	HB1		300	2.01	0.00000
CC - East	HB2		300	2.01	0.00000
CC - East	HB3		300	2.01	0.00000
CC - East	RM10		300	2.01	0.00000
CC - East	RM9		360	2.01	0.00000
CC - East	SR1		300	2.01	0.00000
CC - East	SR2		360	2.01	0.00000
CC - East	SR3		300	2.01	0.00000
CC - East	UH1		300	2.01	0.00000
CC - East	UH2		300	2.01	0.00000
CC - East	UH3		360	2.01	0.00000
CC - East	UH4		360	2.01	0.00000
CC - East	UI1		300	2.01	0.00000
CC - East	UI2		360	2.01	0.00000
CC - East	UI3		360	2.01	0.00000
SM-East	CB1	4	300	2.01	0.00663
SM-East	CB2		270	2.01	0.00000
SM-East	CB4		360	2.01	0.00000
SM-East	CB5		360	2.01	0.00000
SM-East	CB6		360	2.01	0.00000
SM-East	RM15		360	2.01	0.00000
SM-East	RM2		300	2.01	0.00000
SM-East	SCR1		360	2.01	0.00000
SM-East	SCR2		360	2.01	0.00000
SM-East	SCR3		284	2.01	0.00000

2013 Summer Data (06/24/13 - 08/30/13) (eagle minutes <200 meters)

Phase	Survey Point	Minutes GOEA	Minutes BAEA	Obs	Area Obs*	Eagle Exposure[1]
CC - West	CC10			300	2.01	0.00000
CC - West	CC11			300	2.01	0.00000
CC - West	CC12			300	2.01	0.00000
CC - West	CC13	4		300	2.01	0.00663
CC - West	CC2			300	2.01	0.00000
CC - West	CC3	2		300	2.01	0.00332
CC - West	CC4			300	2.01	0.00000
CC - West	CC5	2		300	2.01	0.00332
CC - West	CC6			300	2.01	0.00000
CC - West	CC7			300	2.01	0.00000
CC - West	CC9			300	2.01	0.00000
CC - West	RM12	0		300	2.01	0.00000
CC - West	RM7			300	2.01	0.00000
SM - West	MH1			300	2.01	0.00000
SM - West	MH2			300	2.01	0.00000
SM - West	MH3			300	2.01	0.00000
SM - West	MH4			300	2.01	0.00000
SM - West	MH5			300	2.01	0.00000
SM - West	MH6			300	2.01	0.00000
SM - West	MH7			300	2.01	0.00000
SM - West	MH8			300	2.01	0.00000
SM - West	PG1			300	2.01	0.00000
SM - West	PG10			300	2.01	0.00000
SM - West	PG5			300	2.01	0.00000
SM - West	PG2			300	2.01	0.00000
SM - West	PG3			300	2.01	0.00000
SM - West	PG4			300	2.01	0.00000
SM - West	PG6			300	2.01	0.00000
SM - West	PG7			300	2.01	0.00000
SM - West	PG8			300	2.01	0.00000
SM - West	PG9			300	2.01	0.00000
SM - West	RM14	2		300	2.01	0.00332
CC - East	CMD2			300	2.01	0.00000
CC - East	CMD3	1		300	2.01	0.00166
CC - East	CMD4			300	2.01	0.00000
CC - East	HB1			300	2.01	0.00000
CC - East	HB2			300	2.01	0.00000
CC - East	HB3			300	2.01	0.00000
CC - East	RM10			300	2.01	0.00000
CC - East	RM9			300	2.01	0.00000
CC - East	SR1			300	2.01	0.00000
CC - East	SR2			300	2.01	0.00000
CC - East	SR3			300	2.01	0.00000

2013 Summer Data
Summary of Minutes by Phase

Phase	GOEA	BAEA	Obs
CC - East	1		5,400
CC - West	8		3,900
SM - West	2		5,700
SM-East	5		3,000
Grand Total	**16**	**0**	**18,000**

CC - East	UH1		300	2.01	0.00000
CC - East	UH2		300	2.01	0.00000
CC - East	UH3		300	2.01	0.00000
CC - East	UH4		300	2.01	0.00000
CC - East	UI1		300	2.01	0.00000
CC - East	UI2		300	2.01	0.00000
CC - East	UI3		300	2.01	0.00000
SM-East	CB1		300	2.01	0.00000
SM-East	CB2		300	2.01	0.00000
SM-East	CB4		300	2.01	0.00000
SM-East	CB5		300	2.01	0.00000
SM-East	CB6		300	2.01	0.00000
SM-East	RM15	3	300	2.01	0.00498
SM-East	RM2	2	300	2.01	0.00332
SM-East	SCR1		240	2.01	0.00000
SM-East	SCR2		300	2.01	0.00000
SM-East	SCR3		360	2.01	0.00000

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Appendix D: Summary of Eagle Minutes and Survey Effort for Each Survey Period Based on the Decision Criteria

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Summary of Survey Data for Chokecherry Sierra Madre

** GOEA = Golden Eagle; BAEA = Bald Eagle; Obs = Observation; Min = Minutes

** Eagle minutes are rounded up.

** # = Eagle minutes >150 meters are not included; adjust volume to 150 meters.

** Fall 2012 data are split at 9/16 due to different methods for eagle altitude.

** Data are based on final decision criteria.

2011 Spring to 2012 Spring Data

(04/04/11 - 03/27/12) (15 points) (>150 meters are not included) #

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min	Notes
CC - West	1	3	24801	37	10	
SM - West	1	5	42729	108	22	RM15 included
Total		8	67,530	145	32	

2012 Summer Data

(05/01/12 - 07/24/12) (14 points) (18 eagle minutes >150 meters not included) #

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min	
CC - West	1	2	2124	0	0	
SM - West	1	4	4330	19	0	
Total		6	6,454	19	0	

2012 Fall Data (in part)

(08/20/12 - 09/15/12) (40 points) (23 eagle minutes >150 meters not included) #

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min	
CC - West	1	9	1980	0	0	CC8 excluded
SM - West	1	15	3540	9	0	Exclude PG3
Total		24	5,520	9	0	

2012 Fall Data (in part)

(09/17/12 - 11/09/12) (40 points) (eagle minutes <200 meters)

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min	
CC - West	1	9	3814	13	0	CC8 excluded
SM - West	1	15	6720	13	0	Exclude PG3
Total		24	10,534	26	0	

2012 Winter Data

(11/12/12 - 03/29/13) (60 points)

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min	
CC - West	1	13	5610	8	0	CC13, RM12 Excluded
SM - West	1	21	8760	22	0	Exclude RM15, PG3
Total		34	14,370	30	0	

2013 Spring Data

(04/01/13 - 06/21/13) (60 points)

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min	
CC - West	1	13	3660	2	0	CC13, RM12 Excluded
SM - West	1	21	6000	1	0	Exclude RM15, PG3
Total		34	9,660	3	0	

2013 Summer Data

(06/24/13 - 08/30/13) (60 points)

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min	
CC - West	1	13	3300	4	0	CC13, RM12 Excluded
SM - West	1	21	5400	2	0	Exclude RM15, PG3
Total		34	8,700	6	0	

All Data Combined

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min
CC - West	1	n/a	45289	64	10
SM - West	1	n/a	77479	174	22
Total		0	122,768	238	32

"Year1 "Split **(April 2011-July2012)**

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min
CC - West	1	n/a	26925	37	10
SM - West	1	n/a	47059	127	22
Total			73,984	164	32

"Year2" Split **(August 2012-August 2013)**

Area	Phase	Points	Obs Minutes	GOEA Min	BAEA Min
CC - West	1	n/a	18364	27	0
SM - West	1	n/a	30420	47	0
Total			48,784	74	0

Appendix E: Adjustments to Daylight Hours

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The following is an example of the model code used to calculate annual and seasonal daylight hours.

```
## Define seasonal strata and calculate daylight hours
LatLng<-c(41.6038693,-107.261601)

# Annual Daylight Hours
SeasonType<-"Annual"
DayLtHr<-DayLen(LatLng[2],LatLng[1],Type=SeasonType)
colnames(DayLtHr)[1]<-"Season"
DayLtHr$AveDayLen<-with(DayLtHr,DayLtHr/Days)

# Seasonal Daylight Hours (to determine total daylight hours during curtailment period)
SeasonEndDay<-c(Winter="1/31",Curtail="4/30",Spring="6/30",Summer="8/15",Fall="11/15")
DayLtHr<-DayLen(-107.128973,41.767919,Type=SeasonEndDay,
Labels=names(SeasonEndDay))
DayLtHr$AveDayLen<-with(DayLtHr,DayLtHr/Days)

# Day length based on National Oceanic and Atmospheric Administration solar calculator:
#       http://www.esrl.noaa.gov/gmd/grad/solcalc/calcdetails.html
```

Daylight Operational Hours

Percent of Daylight Operational Hours by "Season" for All Turbines

Row Labels	Average of Winter (Nov 16 - Jan 31)	Average of Curtailment Season (Feb 1 - Apr 30)	Average of Active Nest Season (May 1 - Jun 30)	Average of Summer (Jul 1 - Aug 15)	Average of Fall (Aug 16 - Nov 15)	Average of Entire Year (Jan 1 - Dec 31)
Chokecherry	96.258%	94.582%	94.049%	88.434%	91.543%	93.072%
Sierra Madre	94.468%	93.539%	92.019%	85.087%	89.543%	91.126%
Project Average	95.191%	93.960%	92.839%	86.439%	90.351%	91.912%

Percent of Daylight Operational Hours by "Season" for All Turbines with Seasonal Curtailment

Row Labels	Average of Winter (Nov 16 - Jan 31)	Average of Curtailment Season (Feb 1 - Apr 30)	Average of Active Nest Season (May 1 - Jun 30)	Average of Summer (Jul 1 - Aug 15)	Average of Fall (Aug 16 - Nov 15)	Average of Entire Year (Jan 1 - Dec 31)
Chokecherry	96.258%	94.582%	94.049%	88.434%	91.543%	93.072%
Sierra Madre	94.468%	93.496%	92.019%	85.087%	89.543%	91.126%
Project Average	95.191%	93.951%	92.839%	86.439%	90.351%	91.912%

Seasonal values are an average of percent operational time during daylight hours of individual turbines provided by AWS Truepower, May 2014.

Highlighted values include the curtailment of 17 turbines in Sierra Madre from 1 Feb to 30 April.

Daylight Hours Adjustment for Seasonal Curtailment

	Location	Latitude	Longitude
	Teton Reservoir	41.604	-107.261601

Season	cRange	Days	AveDayLen	DayLtHr
Annual	01/01-12/31	365.25	12.20462	4457.739
Base Annual Daylight Hours for Teton Reservoir				

Season	Day Range	Days	AveDayLen	DayLtHr	Turbines	% Operational	Turbine-Hours*
Winter	11/16-01/31	77.00	9.409873	724.5602	500	95.191%	344,858.18
Curtail	02/01-04/30	89.25	12.020020	1072.7868	500	93.960%	503,996.84
Spring	05/01-06/30	61.00	14.864888	906.7582	500	92.839%	420,911.98
Summer	07/01-08/15	46.00	14.604142	671.7905	500	86.439%	290,344.26
Fall	08/16-11/15	92.00	11.762141	1082.1170	500	90.351%	488,851.57
Calculating Annual Daylight Hours				4458.013		sum=	2,048,962.83
For 500 turbines without Curtailment							4,097.926

Season	Day Range	Days	AveDayLen	DayLtHr	Turbines	% Operational	Turbine-Hours*
Winter	11/16-01/31	77.00	9.409873	724.5602	500	95.191%	344,858.18
Curtail	02/01-04/30	89.25	12.020020	1072.7868	483	93.951%	486,810.25
Spring	05/01-06/30	61.00	14.864888	906.7582	500	92.839%	420,911.98
Summer	07/01-08/15	46.00	14.604142	671.7905	500	86.439%	290,344.26
Fall	08/16-11/15	92.00	11.762141	1082.1170	500	90.351%	488,851.57
Annual Daylight Hours for **500 Turbines** (CC & SM)						sum=	2,031,776.25
With **17 Turbines Curtailed** for 89.25 Days in Sierra Madre							4,063.552

Season	Day Range	Days	AveDayLen	DayLtHr	Turbines	% Operational	Turbine-Hours*
Winter	11/16-01/31	77.00	9.409873	724.5602	298	94.468%	203,973.84
Curtail	02/01-04/30	89.25	12.020020	1072.7868	281	93.496%	281,847.99
Spring	05/01-06/30	61.00	14.864888	906.7582	298	92.019%	248,646.83
Summer	07/01-08/15	46.00	14.604142	671.7905	298	85.087%	170,338.32
Fall	08/16-11/15	92.00	11.762141	1082.1170	298	89.543%	288,749.36
Annual Daylight Hours for **298 Turbines** (Only SM)						sum=	1,193,556.34
With **17 Turbines Curtailed** for 89.25 Days in Sierra Madre							4,005.223

Season	Day Range	Days	AveDayLen	DayLtHr	Turbines	% Operational	Turbine-Hours*
Winter	11/16-01/31	77.00	9.409873	724.5602	202	96.258%	140,884.34
Curtail	02/01-04/30	89.25	12.020020	1072.7868	202	94.582%	204,962.27
Spring	05/01-06/30	61.00	14.864888	906.7582	202	94.049%	172,265.15
Summer	07/01-08/15	46.00	14.604142	671.7905	202	88.434%	120,005.94
Fall	08/16-11/15	92.00	11.762141	1082.1170	202	91.543%	200,102.21
Annual Daylight Hours for **202 Turbines** (Only CC)						sum=	838,219.90
No pre-planned curtailment in Chokecherry							4,149.603

*TurbineHours = DayLtHr*Turbines*%Operational

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Appendix F: Eagle Fatality Model Inputs and Results

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Predicted Fatalities

Golden Eagle, Chokecherry Sierra Madre combined, 103-m blade

Golden Eagle, Chokecherry Sierra Madre combined, 120-m blade

Bald Eagle, Chokecherry Sierra Madre combined, 103-m blade

Bald Eagle, Chokecherry Sierra Madre combined, 120-m blade

Golden Eagle, Chokecherry, 103-m blade

Golden Eagle, Sierra Madre, 103-m blade

Golden Eagle, Chokecherry, 120-m blade

Golden Eagle, Sierra Madre, 120-m blade

Bald Eagle, Chokecherry, 103-m blade

Bald Eagle, Sierra Madre, 103-m blade

Bald Eagle, Chokecherry, 120-m blade

Bald Eagle, Sierra Madre, 120-m blade

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Eagle Fatality Model Inputs and Results

Model inputs and results are combined for Chokecherry and for Sierra Madre.
Posterior from Year1 becomes the prior for Year2.
Results from Year2 are a combination of data from Year1 and Year2.
Results from Year2 are the "final" predicted eagle fatalities.
Fatalities are predicted for two different turbine blade lengths: 103-meter and 120-meter diameter blades.

"Year" and Dates	GOLDEN EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	GOEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~8% non-operational period; includes data from RM15.	Chokecherry Sierra Madre	800	73,984
"Year 2" August 2012 to August 2013	GOEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~8% non-operational period; does not include RM15. Does not inlcude CC8, CC13, RM12 and PG3 starting Fall 2012.. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Chokecherry Sierra Madre	800	48,784

"Year" and Dates	GOLDEN EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	GOEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~8% non-operational period; includes data from RM15.	Chokecherry Sierra Madre	800	73,984
"Year 2" August 2012 to August 2013	GOEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~8% non-operational period; does not include RM15. Does not inlcude CC8, CC13, RM12 and PG3 starting Fall 2012.. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Chokecherry Sierra Madre	800	48,784

[redacted]

Golden Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
164	4,063.6	103/2	500	0.443	0.0345	8.7	5.7	13
74	4,063.6	103/2	500	0.346	0.0224	6.8	4.5	10
Golden Eagle annual predicted fatalities with 103-m diameter blade =								**10**

Golden Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
164	4,063.6	120/2	500	0.443	0.0344	12	7.8	17
74	4,063.6	120/2	500	0.347	0.0224	9.2	6.1	14
Golden Eagle annual predicted fatalities with 120-m diameter blade =								**14**

"Year" and Dates	BALD EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	BAEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~8% non-operational period; includes data from RM15.	Chokecherry Sierra Madre	800	73,984
"Year 2" August 2012 to August 2013	BAEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~8% non-operational period; does not include RM15. Does not inlcude CC8, CC13, RM12 and PG3 starting Fall 2012.. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Chokecherry Sierra Madre	800	48,784

"Year" and Dates	BALD EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	BAEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~8% non-operational period; includes data from RM15.	Chokecherry Sierra Madre	800	73,984
"Year 2" August 2012 to August 2013	BAEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~8% non-operational period; does not include RM15. Does not inlcude CC8, CC13, RM12 and PG3 starting Fall 2012.. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Chokecherry Sierra Madre	800	48,784

Bald Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
32	4,063.6	103/2	500	0.0886	0.0154	1.7	1.2	2.6
0	4,063.6	103/2	500	0.0478	0.0084	0.94	0.79	1.4
	Bald Eagle annual predicted fatalities with 103-m diameter blade =							**1.4**

Bald Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
32	4,063.6	120/2	500	0.0884	0.0154	2.3	1.6	3.5
0	4,063.6	120/2	500	0.0477	0.0083	1.3	0.87	1.9
	Bald Eagle annual predicted fatalities with 120-m diameter blade =							**2**

Eagle Fatality Model Inputs and Results - GOLDEN EAGLE

Model inputs and data results are run separately for Chokecherry and for Sierra Madre.
Posterior from Year1 becomes the prior for Year2.
Results from Year2 are a combination of data from Year1 and Year2.
Results from Year2 are the "final" predicted eagle fatalities.
Fatalities are predicted for two different turbine blade lengths: 103-meter and 120-meter diameter blades.

"Year" and Dates	GOLDEN EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	GOEA minutes based on observation times in GIS file, adjusted for flight paths and volume adusted for flight heights. Daylight adjusted for about 7% non-operational period, no seasonal curtailment.	Chokecherry	800	26,925
"Year 1" April 2011 to July 2012	GOEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~9% non-operational period; includes data from RM15.	Sierra Madre	800	47,059
"Year 2" August 2012 to August 2013	GOEA minutes based on 4 survey periods, adjusted for flight heights. Daylight adjusted for ~7% non-operational period; no seasonal curtailment. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume). Does not inlcude CC8, CC13 and RM12 starting Fall 2012.	Chokecherry	800	18,364
"Year 2" August 2012 to August 2013	GOEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~9% non-operational period; does not include RM15. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Sierra Madre	800	30,420

Golden Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
37	4,149.6	103/2	202	0.279	0.0455	2.3	1.5	3.3
127	4,005.2	103/2	298	0.540	0.0476	6.2	4.2	9.2
27	4,149.6	103/2	202	0.254	0.315	2.1	1.4	3.0
47	4,005.2	103/2	298	0.402	0.0304	4.6	3.1	6.8
Golden Eagle annual predicted fatalities with 103-m diameter blade =								**10**

Note: because Chokecherry and Sierra Madre are analyzed independently, their results are rounded up before being added together.

"Year" and Dates	GOLDEN EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	GOEA minutes based on observation times in GIS file, adjusted for flight paths and volume adusted for flight heights. Daylight adjusted for about 7% non-operational period, no seasonal curtailment.	Chokecherry	800	26,925
"Year 1" April 2011 to July 2012	GOEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~9% non-operational period; includes data from RM15.	Sierra Madre	800	47,059
"Year 2" August 2012 to August 2013	GOEA minutes based on 4 survey periods, adjusted for flight heights. Daylight adjusted for ~7% non-operational period; no seasonal curtailment. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume). Does not inlcude CC8, CC13 and RM12 starting Fall 2012.	Chokecherry	800	18,364
"Year 2" August 2012 to August 2013	GOEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~9% non-operational period; does not include RM15. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Sierra Madre	800	30,420

Golden Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
37	4,149.6	120/2	202	0.280	0.0454	3.1	2.1	4.5
127	4,005.2	120/2	298	0.540	0.0477	8.5	5.6	12
27	4,149.6	120/2	202	0.254	0.0315	2.8	1.9	4.1
47	4,005.2	120/2	298	0.402	0.0304	6.3	4.1	9.2
Golden Eagle annual predicted fatalities with 120-m diameter blade =								**15**

Note: because Chokecherry and Sierra Madre are analyzed independently, their results are rounded up before being added together.

Eagle Fatality Model Inputs and Results - BALD EAGLE

Model inputs and data results are run separately for Chokecherry and for Sierra Madre.
Posterior from Year1 becomes the prior for Year2.
Results from Year2 are a combination of data from Year1 and Year2.
Results from Year2 are the "final" predicted eagle fatalities.
Fatalities are predicted for two different turbine blade lengths: 103-meter and 120-meter diameter blades.

"Year" and Dates	BALD EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	BAEA minutes based on observation times in GIS file, adjusted for flight paths and volume adusted for flight heights. Daylight adjusted for about 7% non-operational period, no seasonal curtailment.	Chokecherry	800	26,925
"Year 1" April 2011 to July 2012	BAEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~9% non-operational period; includes data from RM15.	Sierra Madre	800	47,059
"Year 2" August 2012 to August 2013	BAEA minutes based on 4 survey periods, adjusted for flight heights. Daylight adjusted for ~7% non-operational period; no seasonal curtailment. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume). Does not inlcude CC8, CC13 and RM12 starting Fall 2012.	Chokecherry	800	18,364
"Year 2" August 2012 to August 2013	BAEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~9% non-operational period; does not include RM15. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Sierra Madre	800	30,420

[redacted]

Bald Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
10	4,149.6	103/2	202	0.0807	0.0244	0.65	0.53	0.97
22	4,005.2	103/2	298	0.0969	0.0202	1.1	0.78	1.6
0	4,149.6	103/2	202	0.0429	0.013	0.35	0.26	0.51
0	4,005.2	103/2	298	0.0528	0.0111	0.61	0.51	0.9
	Bald Eagle annual predicted fatalities with 103-m diameter blade =							**2**

Note: because Chokecherry and Sierra Madre are analyzed independently, their results are rounded up before being added together.

"Year" and Dates	BALD EAGLE Notes	Location	Radius	Survey Minutes
"Year 1" April 2011 to July 2012	BAEA minutes based on observation times in GIS file, adjusted for flight paths and volume adusted for flight heights. Daylight adjusted for about 7% non-operational period, no seasonal curtailment.	Chokecherry	800	26,925
"Year 1" April 2011 to July 2012	BAEA minutes based on observation times in GIS file, adjusted for flight paths and volume adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89.25 days in spring, plus ~9% non-operational period; includes data from RM15.	Sierra Madre	800	47,059
"Year 2" August 2012 to August 2013	BAEA minutes based on 4 survey periods, adjusted for flight heights. Daylight adjusted for ~7% non-operational period; no seasonal curtailment. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume). Does not inlcude CC8, CC13 and RM12 starting Fall 2012.	Chokecherry	800	18,364
"Year 2" August 2012 to August 2013	BAEA minutes from 4 survey periods, adjusted for flight heights. Daylight adjusted for 17 turbines curtailed for 89 days in spring, plus ~9% non-operational period; does not include RM15. Year1 posterior becomes Year2 prior. Model code modified to account for height (volume).	Sierra Madre	800	30,420

Bald Eagle Minutes	Daylight Hours	Blade Length	Turbines	Eagle Exposure	Exposure Std Dev	Average Fatality	Fatality Std Dev	80% UCI Fatality
10	4,149.6	120/2	202	0.0808	0.0245	0.89	0.66	1.3
22	4,005.2	120/2	298	0.0969	0.0203	1.5	1.3	2.2
0	4,149.6	120/2	202	0.0427	0.013	0.47	0.35	0.7
0	4,005.2	120/2	298	0.0527	0.011	0.82	0.58	1.2
	Bald Eagle annual predicted fatalities with 120-m diameter blade =							**3**

Note: because Chokecherry and Sierra Madre are analyzed independently, their results are rounded up before being added together.

Appendix G: Example of Model Code Used to Predict Eagle Fatalities

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The following is an example of the model code and inputs used by the U.S. Fish and Wildlife Service to predict the number of bald eagle and golden eagle fatalities at the Chokecherry Sierra Madre Phase 1 Project. The description, inputs and results of the twelve different model runs are presented in Appendix F.

In the example below, differences between the model runs are identified. Comments and other explanatory notes that may differ between model runs are highlighted in yellow. Changes to the model inputs or the model code are identified by red, bolded text and are highlighted in yellow. These changes, which are also identified by sequential numerals surrounded by asterisks and parentheses, are further explained here:

(*1*) – Description of the model run, including area (e.g., Chokecherry) and year (e.g., Year 1)
(*2*) – Number of turbines (i.e., 500, 298, or 202)
(*3*) – Blade length (i.e., 120- or 103-meter blade)
(*4*) – Description of the run,
    Number of eagle minutes
    Number of counts (total observation minutes / 60)
    Daylight hours (see Appendix E)
(*5*) – Adjust sample volume (e.g., 150 or 200 meters / 100)
(*6*) – For all 12 runs, the priors for Year 1 were adjusted to account for non-standard volume
(*7*) – The posteriors for Year 1 were used as the priors for Year 2

```
# Example Code for Model Run
# CC & SM West for GOEA with 120-m rotor blade Yr1Pooled and Yr2Pooled
# all eagle observations were recorded up to 150-m
# requires FWS functions R2Gamma.R, FatalFcns.R, and RVSmry.R and the R packages rv and
#      maptools

### Chokecherry Sierra Madre West Yr1 - below 150m ###

cProject<-"CCSM_West_Yr1_150m"      #project ID                                    (*1*)
nTurbine<-c(500)                    #number of turbines                            (*2*)
HazRadKm<-c(120/2/1000)      #radius of hazardous area around each turbine(in kilometers)  (*3*)
HzKM2<-(nTurbine*pi*HazRadKm^2)   # hazardous area will be converted to volume later
CntHr<-c(1)                         # count duration (in hours)

## Create the "ExpSvy" data frame (Eagle Minutes observed, number of counts conducted,
#         the area observed at each observation point, and the future daylight hours),
#         includes some observed EMin with no ht recorded

# (*4*)
ExpSvy<-data.frame(row.names=c("CCSM_Y1-150m"),
              EMin=c(164),
              nCnt=c(1233.067),
              CntKM2=c(pi*0.8^2),
              DayLtHr=c(4063.552))

# DayLtHr includes ~8% non-operational hours annually (17 turbines curtailed 89.25 days in spring)

AddTot<-FALSE          #Add strata for total (TRUE) or not (FALSE)
## Analysis Inputs ##
UCI<-c(0.5,0.8,0.9,0.95)
nSims<-100000
setnsims(nSim)
PlotFile<-NULL

## Survey Inputs ##
nSvy<-nrow(ExpSvy)
cSvy<-(rownames(ExpSvy))

## Modified expansion and offset calculations
# we multiply the "offset" (the sampling effort that goes with the eagle minutes observed
#      and is used to calculate the exposure) by 150-m (0.15 km) to give us eagle mins per hr*km^3
# (*5*)
Height <- c(0.15)
SmpHrKM3<- with(ExpSvy,nCnt*CntHr*CntKM2*Height)

# we multiply the "expansion factor" (the product of operational daylight hours and
```

```
#      hazardous area) by 200-m (0.2 km)
ExpFac<- ExpSvy$DayLtHr*HzKM2*.2

# Calculate the fatalities and store as a temporary object.                    (*6*)
tmp<-with(ExpSvy,mapply(simFatal,EMin=EMin,SmpHrKM2=SmpHrKM3,ExpFac=ExpFac,
                  aPriExp=0.9684375,bPriExp=0.5519703,aPriCPr=2.31,bPriCPr=396.69,
                  SIMPLIFY=FALSE))

# Put the survey specific simulations in an rv vector.
Fatalities<-rvnorm(nSvy)
Exp<-data.frame(Mean=rep(NA,nSvy),SD=NA,row.names=cSvy)
for(i in 1:nSvy){
 # i<-1
 Fatalities[i]<-tmp[[i]]
 Exp[i,]<-attr(tmp[[i]],"Exp")
}
rm(tmp)
names(Fatalities)<-cSvy

# Summarize
nSvy<-length(Fatalities)
if(is.null(nSvy))nSvy<-1
FatalStats<-RVSmry(cSvy,Fatalities,probs=UCI)
if(AddTot){
 FatalStats<-rbind(
  FatalStats,
  RVSmry("Total",sum(Fatalities),probs=UCI))}
# Determine Yr2 exposure prior parameters from the Yr1 exposure posterior
Prior2<-N2Gamma(mn=Exp$Mean,sd=Exp$SD)

# define objects to pull into the simFatal function for Year2
aPriExpY2<-Prior2[1]
bPriExpY2<-Prior2[2]

### Chokecherry Sierra Madre West Yr2 ###

cProject<-"CCSM_West_Yr2"          #project ID to associate with model outputs      (*1*)
nTurbine<-c(500)                   #number of turbines                              (*2*)
HazRadKm<-c(120/2/1000)     #radius of hazardous area around each turbine (in kilometers)  (*3*)
HzKM2<-(nTurbine*pi*HazRadKm^2)   # hazardous area will be converted to volume

# (*4*) (*5*)
## Create the "ExpSvy" data frame by pooling data
EMinPooled<-sum(9,26,30,3,6)
SmpHr<-c(5520/60,10534/60,14370/60,9660/60,8700/60)
SmpKM2<-pi*0.8^2
```

```
SmpHt<-c(0.15,0.2,0.2,0.2,0.2)
SmpHrKM3Pooled<-sum(SmpKM2*SmpHr*SmpHt)

ExpSvy<-data.frame(row.names=c("Yr2_Pooled"),
            Emin=EminPooled,
            SmpHrKM3=SmpHrKM3Pooled,
            DayLtHr=4063.552)

# DayLtHr includes ~8% non-operational hours annually (17 turbines curtailed 89.25 days in spring)

AddTot<-FALSE         #Add strata for total (TRUE) or not (FALSE)

## Analysis Inputs (if different than Year 1)##
## Survey Inputs ###
nSvy<-nrow(ExpSvy)
cSvy<-(rownames(ExpSvy))

## Modified expansion and offset calculations
ExpFac<- ExpSvy$DayLtHr*HzKM2*.2

# Calculate the fatalities and store as a temporary object.                    (*7*)
tmp<-mapply(simFatal,EMin=ExpSvy$EMin,SmpHrKM2=ExpSvy$SmpHrKM3,ExpFac=ExpFac,
        aPriExp=aPriExpY2,bPriExp=bPriExpY2,aPriCPr=2.31,bPriCPr=396.69,
        SIMPLIFY=FALSE)

# Put the survey specific simulations in an rv vector.
Fatalities<-rvnorm(nSvy)
Exp<-data.frame(Mean=rep(NA,nSvy),SD=NA,row.names=cSvy)
for(i in 1:nSvy){
 # i<-1
 Fatalities[i]<-tmp[[i]]
 Exp[i,]<-attr(tmp[[i]],"Exp")
}
rm(tmp)
names(Fatalities)<-cSvy

# Summarize the surveys, including a total if needed.
nSvy<-length(Fatalities)
if(is.null(nSvy))nSvy<-1
FatalStats<-RVSmry(cSvy,Fatalities,probs=UCI)
if(AddTot){
 FatalStats<-rbind(
  FatalStats,
  RVSmry("Total",sum(Fatalities),probs=UCI)
 )}
```