A. Sage-grouse Monitoring Protocol

Cotterel Mountain Annual Sage-grouse Monitoring Protocol

Photo by T.D. Reynolds

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1.0 INTRODUCTION

Greater sage-grouse (Centrocercus urophaisanus) populations have declined throughout much of their former range and have been extirpated from Arizona, New Mexico, Nebraska, and British Columbia (Connelly and Braun 1997, Schroeder *et al.* 1999, Connelly *et al.* 2004). Estimates of regional declines range from 17 to 47% (Connelly and Braun 1997). Greater sage-grouse currently occupy 56% of their historical range, which once covered approximately 1,200,000 square kilometers (km2) (Schroeder *et al.* 2004).

Due to these declines, at least seven petitions have been submitted to the U.S. Fish and Wildlife Service requesting either some populations or the entire species be listed under the Endangered Species Act. These petitions are based on concerns for long-term conservation because of potential threats to the species and the sagebrush habitats on which it depends (Wambolt 2002). A decision to give the greater sage-grouse protected status across its entire range may have significant consequences for management and use of a large part of the western United States. Presently, multiple-use management dominates approximately 70% of the sagebrush habitats, which are owned publicly (Box 1990, Poling 1991). Uses that may influence sagebrush habitats include mining, energy development, conversion to agriculture, and urbanization. Other uses, such as livestock grazing and use of off-road vehicles for recreation, also have the potential to influence habitats and populations of sage-grouse.

The greater sage-grouse is entirely dependent on sagebrush (Artemisia spp.) ecosystems that dominate much of western North America. Major characteristics of the landscape that early European explorers once described as a vast sea of sagebrush (Fremont 1845) have been altered from pre-settlement conditions. One of these characteristics is the configuration of sagebrush habitats within the larger context of the landscape. Increased edges in landscapes fragmented by roads, power-lines, fences, and other linear features promotes spread of exotic invasive species, facilitates predator movements, and isolates wildlife populations (Connelly *et al.* 2004). In addition, elevated features including fences, power poles, and towers may alter sage-grouse use of landscapes by causing grouse to avoid these areas or result in increased mortality due to direct strikes and providing perch sites for raptors and corvids.

Unfortunately, little is known about the effects of wind power development on sage-grouse use of landscapes or the species' vital rates. This knowledge will become increasingly important as more projects are proposed in sagebrush-dominated habitats and public and private groups strive to meet the nation's energy requirements while still protecting its natural resources. The Cotterel Mountain area is known to provide habitat for a relatively isolated breeding population of greater sage-grouse. Here we provide an approach to assessing both the short and long-term response of sage-grouse to the project and to mitigation implemented to balance the impacts of the project.

The objectives of sage-grouse monitoring at Cotterel Mountain will be to: (1) identify areas used for nesting, brood rearing, and wintering during the construction and operation of the project; (2) update established baseline data regarding movement, productivity, and survival; and (3) analyze monitoring data to evaluate the effects of construction and operation on sage-grouse populations.

1.1 STUDY AREA

Monitoring will take place in sagebrush-dominated habitats on Cotterel Mountain and adjacent Jim Sage and Albion mountain ranges. All areas contain sage-grouse breeding habitat, and earlier work indicated that sage-grouse from the Cotterel area move to the adjacent mountain ranges during parts of the year (G. Servheen, IDFG, personal communication).

The project right-of-way would extend for 14 miles along Cotterel Mountain and include the construction of 81-98 turbines and development of 19 miles of new road. The development may affect sage-grouse associated with 6 leks occurring within the project area and grouse occupying approximately 59,000 ha of habitat.

Brown's Bench, lying roughly 47 miles to the west of Cotterel Mountain, will serve as a control area. Brown's Bench supports communities of low sagebrush (A. arbuscula) and black sagebrush (A. nova) as well as stands of Wyoming big sagebrush (A. tridentata wyomingensis). The area contains sage-grouse breeding habitat and leks are routinely monitored by Idaho Department of Fish and Game personnel. Additionally, this area is currently the center of an intensive research effort on sage-grouse population ecology and would thus provide data allowing comparisons to population change in and adjacent to the development.

2.0 BREEDING POPULATION MONITORING AND LEK COUNTS

Sage-grouse breeding populations will be tracked annually each spring at traditional display areas (leks) on and near Cotterel Mountain, and compared with data collected by Idaho Fish and Game at other control sites, to evaluate the effect of construction and operation of the Cotterel Wind Power Project on the population. Monitoring has been conducted before construction of the project. During and following construction, monitoring will continue for a period of five years. At the end of the fifth year the monitoring effort will be evaluated to determine if additional monitoring would continue to provide useful information on the local sage-grouse population.

Lek counts will adhere to the protocol accepted by the Idaho Department of Fish and Game (Connelly *et al.* 2003), and will be conducted from approximately mid- to late- March through early May. All Terrain Vehicles (ATVs) will be used for access to the leks. All historic and any new leks identified during monitoring on Cotterel Mountain (Figure 1) will be censused a minimum of three times each during the breeding season (March-May). Lek censuses will be performed in the following manner:

1. A spot will be located that provides good visibility of the entire lek. If the lek is large, two or more vantage points may be necessary.

2. From this suitable vantage point, the observer will scan a given lek from left to right (or vice versa), counting all displaying males and females.

3. The observer will wait one to two minutes, then re-count the lek from right to left (opposite direction of first count).

4. After waiting a minimum of one to two minutes, the observer will then repeat the process. The maximum number of males and females observed during all scans will be recorded separately.

Although the Idaho Department of Fish and Game protocol suggests that counts should be discontinued one hour after sunrise, previous sage-grouse studies on Cotterel Mountain (Reynolds and Hinckley 2005) indicated that most birds continued to display until mid-morning. Therefore, counts could be continued until approximately 0830 if male grouse continue to display.

Although methods for estimating breeding population numbers from lek count data have not been rigorously tested for accuracy the following formula is considered to provide a crude estimate of minimum population numbers (Connelly *et al.* 2003). Until a better estimator is developed, this formula will be used to estimate the population of greater sage-grouse on Cotterel Mountain each spring:

$$(A/0.75)*2 = B$$

Where:

A is the sum of the maximum number of displaying males observed on all leks, 0.75 represents an estimate of the number of males not observed, 2 is the presumed sex ratio of females to males, and B is the estimated springtime population of greater sage-grouse.

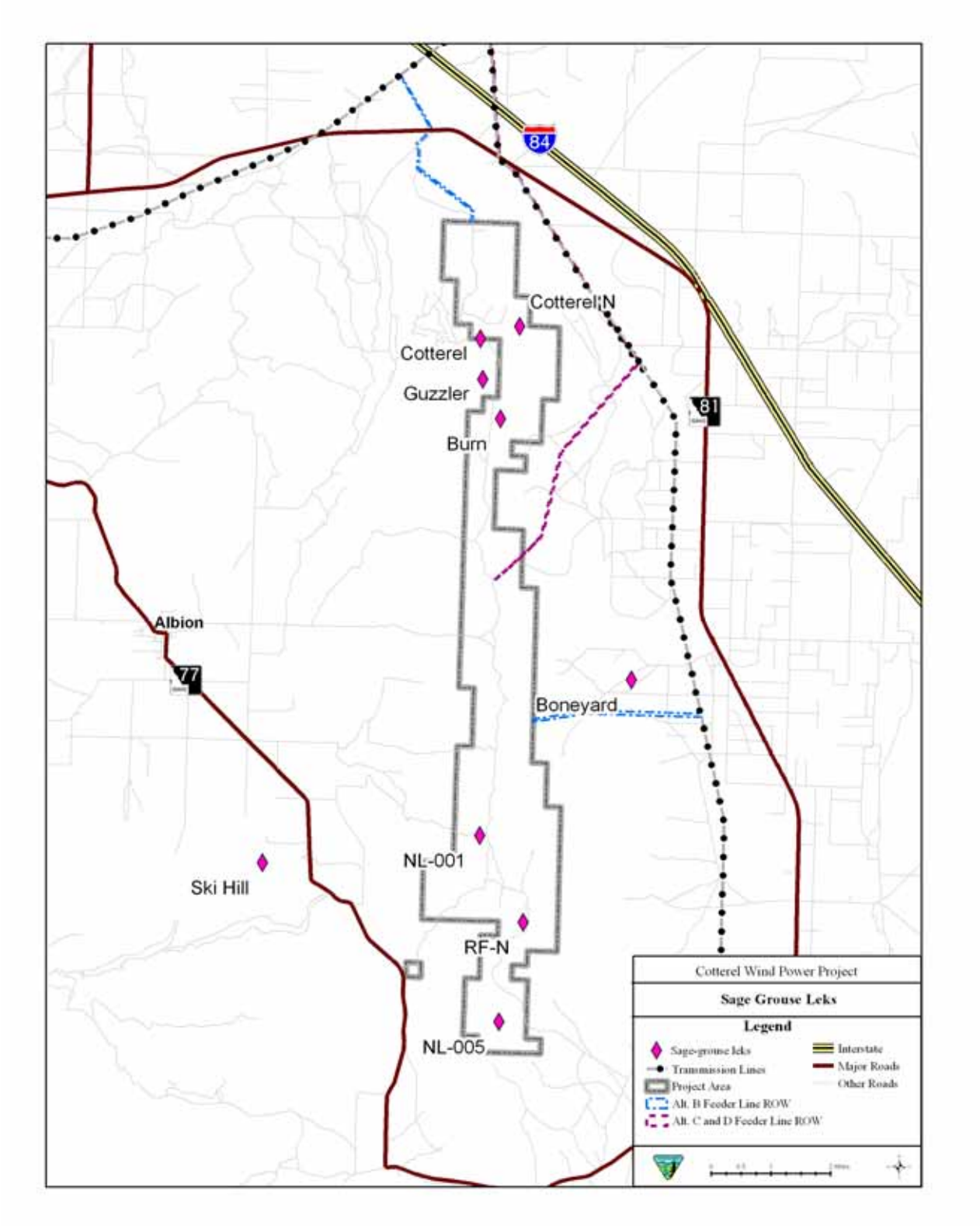

Figure 1. Sage-grouse Lek Locations on or in the Vicinity of Cotterel Mountain.

3.0 MOVEMENT, PRODUCTIVITY, AND SURVIVAL MONITORING

The annual movements of sage-grouse will be monitored in an effort to identify areas used for nesting, brood-rearing, and wintering. Sage-grouse productivity and annual survival will also be estimated. Two years of pre-construction monitoring regarding these sage-grouse parameters (TREC 2005) provides a foundation from which to measure and evaluate any potential impacts that could result from the construction and operation of wind energy development.

3.1 CAPTURE

Sage-grouse will be captured and radio-collared using backpack night-lighting techniques (Wakkinen *et al*. 1992, Connelly *et al.* 2003). Individual grouse will be sexed and aged as juveniles (has not entered into its first breeding season), sub-adults (has entered its first breeding season but not completed its second summer molt, generally 10-17 months old) or adults (has entered or is about to enter its second breeding season, generally ≥15 months old) based on characteristics of the outer wing primaries (Dalke *et al.* 1963, Connelly *et al.* 2003). Captured grouse will be leg-banded with single serially-numbered aluminum leg bands. Each lek will be assigned a color and captured grouse will be outfitted with leg bands colored to correspond with their lek of capture. All captured birds will be radio-collared with necklace-mounted radio-transmitters. Radio-transmitters provide the most useful means of documenting seasonal sage-grouse habitat selection, movements, and productivity (ISAC 2005). Radio-collars will be equipped with 4-hour mortality sensors. Grouse shall be weighed and released at the point of capture.

3.2 MONITORING AND MOVEMENTS

All marked grouse will be located monthly at a minimum. Grouse shall be located on the ground with a hand-held antenna and receiver, using the loudest signal method (Springer 1979). A fixed-wing aircraft, equipped for radio-telemetry, will be used to locate any missing grouse. During the nesting season, females will be located weekly. When a female is in the same location on two successive radio-tracking sessions, incubation will be assumed to have begun. The nest site will be inconspicuously marked by attaching a small (<10 cm) strip of plastic flagging to vegetation at ~8 m (25 ft) on either side of the nest to avoid flushing the hen from her nest, with the nest on a line between the two flags.

The distance from lek of capture to initial nest and re-nest sites will be calculated for all hens that attempt to nest. During spring and summer, movements will be estimated for individual grouse by calculating a mean distance from lek of capture to all subsequent locations. A median distance moved for both off-mountain and Cotterel Mountain sage-grouse, as well as for each gender, shall then be calculated. All movement and home range estimates will be derived using ArcGIS (Environmental Systems Research Institute 2006). A 95% fixed kernel (FK) home range will be estimated for (1) all grouse radio-marked on Cotterel Mountain and (2) all grouse captured off of Cotterel Mountain.

3.3 PRODUCTIVITY

Nesting effort will be estimated as the proportion of hens alive at the onset of nesting that attempt to nest. Re-nesting effort will be estimated as the proportion of hens that survive an initial nest failure, which then attempt to re-nest. Nest success, hatching success, hen success, clutch size, and egg fertility will be determined by inspecting nests of radio-marked hens as soon as possible after the hens have departed. A nest will be considered successful if at least one egg in the nest hatches.

Nest success will be calculated as the proportion of nests in which at least one egg hatches. Eggshell fragments with separated membranes and typical hatching pattern of the shell (Rearden 1951) will indicate a successful hatch. Hatching success will be the proportion of all eggs laid in successful nests that hatch. Hen success will be calculated as the proportion of hens that hatch at least one egg, regardless of the number of nesting attempts. Clutch size will be determined for successful nests by counting the number of un-hatched and hatched eggs present at a nest site after hatching occurs. Egg fertility will be calculated as the proportion of all eggs laid in successful nests that are fertile, based on a successful hatch or presence of a partially developed embryo in un-hatched eggs. Broods will be flushed and counted at six weeks of age using a trained hunting dog. Brood size will be calculated as the mean number of chicks per hen at six weeks of age, using all hens alive at the onset of nesting. Chick survival will be calculated as the number of chicks that survive to six weeks of age from all eggs that hatch in successful nests. Nest site fidelity will be calculated as the mean distance moved from an initial nest site from one year to the next, using only females that survive and nest in consecutive years.

3.4 SURVIVAL

Annual survival of radio-marked sage-grouse will be calculated monthly using the Kaplan-Meier method (Kaplan and Meier 1958) with staggered entry of individuals (Pollock *et al.* 1989). Grouse will be included in survival estimates only if they survive for at least one week after being outfitted with radio-collars, to ensure that mortalities are not related to capture stress or injury. Counts of sage-grouse harvested during upland game bird hunting seasons, or found to be illegally taken, during or off-season will be included in the monitoring protocols.

3.5 MITIGATION MONITORING

If off-site mitigation includes habitat enhancement or restoration projects, these areas will be monitored in accordance with II. Environmental Protection Measures, and II.1 Biological Resources.

4.0 REPORTING

Results of each year of sage-grouse monitoring will be summarized in an annual report. The report will include complete data sets for all sage-grouse monitoring data collected. The report will be submitted to the Bureau of Land Management (BLM) Burley Field Office by January 15th of each year. Preliminary and final results will be presented at scientific

meetings and final results will be published in the peer-review literature. A final project report will be completed within one year of finishing the initial five years of fieldwork.

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