Best Management Practices for Electric Utilities in Sage-Grouse Habitat

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1.0 EXECUTIVE SUMMARY

The Avian Power Line Interaction Committee (APLIC) is a collaborative of electric utilities, resource agencies, and conservation organizations that addresses a variety of avian/power line interactions including electrocutions, collisions, nests, and avian concerns associated with construction, maintenance, and operation of electric transmission and distribution infrastructure. APLIC's mission is to lead the electric utility industry in protecting avian resources while enhancing reliable energy delivery. Some of APLIC's recent efforts have focused on assessing impacts to sage-grouse[1] and sagebrush habitat from electric utility infrastructure.

Wildlife scientists and public land managers have expressed concerns that new and existing electric transmission and distribution structures may be contributing alone or in concert with other stressors, to impact sage-grouse and their habitat. Currently, literature on the impacts to sage-grouse due to transmission or distribution lines is limited. Siting guidelines and stipulations for utility infrastructure in sage-grouse habitat vary among state and federal agencies, as well as within federal agencies. The effectiveness of these siting guidelines and stipulations such as lek buffer distances and seasonal construction or maintenance restrictions has not been adequately evaluated in relation to electric utility activities. A recently published report by the U.S. Geological Survey (Manier et al. 2014) stated that "there is no single distance that is an appropriate buffer for all populations and habitats across the sage-grouse range." This document also noted the difficulty in assessing effects of tall structures due to limited research and confounding effects of other, co-located infrastructure. However, as more information has been obtained on buffer distances in general (e.g., Coates et al. 2013) and agency planning documents are updated, there have been recent efforts to provide consistency among different timing and distance restrictions in federal land use plans and among federal and state conservation management plans.

In response to sage-grouse/power line concerns, uncertainties related to siting and permitting of new lines, and variability in timing and disturbance distance guidance, APLIC convened a group of utility, federal, and state agency partners to develop best management practices (BMPs) that would aid in addressing siting and ongoing operation and maintenance (O&M) concerns and help conserve sage-grouse and their habitat.

The voluntary BMPs presented and discussed herein are intended to provide consistent and implementable actions that comply with and enhance sage-grouse-specific conservation measures, recommendations, and requirements contained within federal and state management plans. These BMPs are not intended to replace or conflict with existing agency plans, but rather provide additional detail and benefit, specific to electric transmission and distribution infrastructure and related actions. The BMPs were categorized under various activities conducted

[1] Throughout this document, the term "sage-grouse" is used to collectively, referring to both greater sage-grouse (*Centrocercus urophasianus*) and Gunnison sage-grouse (*C. minimus*).

by utilities and also aligned with potential threats identified in the 2013 U.S. Fish and Wildlife Service (USFWS) Conservation Objectives Team (COT) Report. APLIC encourages the use of and reference to these BMPs during permitting and permit renewal of electric facilities in conjunction with state and federal sage-grouse plans. APLIC further encourages utilities that operate in sage-grouse habitat to directly reference or incorporate these BMPs into their internal company procedures during construction and O&M of existing power lines and associated infrastructure (e.g., access roads).

Utilities and agencies that implement the BMPs contained within this document are encouraged to evaluate their effectiveness and communicate this information to APLIC, resource agencies, and other utilities, thereby providing valuable information for future revisions of this document. This is a “living document” and will be updated or revised as needed to reflect new science, techniques, resources, or regulatory requirements.

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2.1 What is APLIC?

The Avian Power Line Interaction Committee (APLIC) was formed in 1989 as a collaborative effort among electric utilities, resource agencies, and conservation organizations to address whooping crane collisions with power lines. Since its inception, APLIC has expanded to address a variety of avian/power line interactions including electrocutions, collisions, nests, and avian concerns associated with construction, maintenance, and operation of electric transmission and distribution infrastructure.

Current APLIC membership includes electric utilities in the United States and Canada, Edison Electric Institute (EEI), Electric Power Research Institute (EPRI), National Rural Electric Cooperative Association (NRECA), Rural Utilities Service (RUS), and the U.S. Fish and Wildlife Service (USFWS). For more information about APLIC and upcoming training workshops, see www.aplic.org. APLIC's mission is to lead the electric utility industry in protecting avian resources while enhancing reliable energy delivery. APLIC works in partnership with utilities, resources agencies, and the public to:

- Develop and provide educational resources
- Identify and fund research
- Develop and provide cost-effective management options, and
- Serve as the focal point for avian interaction utility issues

Since the 1970s, APLIC has produced and updated manuals for addressing avian electrocutions and collisions including the most recent publications: *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* and *Reducing Bird Collisions with Power Lines: The State of the Art in 2012*. In 2005, APLIC and the USFWS jointly released *Avian Protection Plan Guidelines*, which offers a "toolbox" for utilities to address avian issues. In addition, APLIC offers short courses annually that provide an overview of avian/power line issues and solutions, including collisions, electrocutions, nests on utility structures, and construction impacts. APLIC also funds bird/power line research and has sub-groups that address species-specific considerations, such as sage-grouse.[3]

APLIC member utilities are committed to constructing, operating, and maintaining their infrastructure to deliver safe, reliable, and efficient power in ways that avoid and minimize environmental impacts, particularly in regard to birds and other wildlife, and their habitats.

[3] Throughout this document, the term "sage-grouse" is used to collectively, referring to both greater sage-grouse (*Centrocercus urophasianus*) and Gunnison sage-grouse (*C. minimus*).

3.0 INTRODUCTION AND PURPOSE

Increasing demands for electricity and the development of energy projects require construction of new power lines and upgrades of existing infrastructure to transmit electricity from where it is generated, which is often in remote areas, to more populated load centers and/or new customers. The USFWS lists energy development as a threat to sage-grouse (USFWS 2013). Impacts of tall structures,[4] such as power lines, on sage-grouse in exclusion of other anthropogenic features have not been well-studied or understood (Manier et al. 2014). However, research has documented that cumulative impacts of anthropogenic development (e.g., residential development and oil and gas facilities) can have significant, negative impacts on sage-grouse populations (Knick et al. 2013, Johnson et al. 2011, Leu and Hanser 2011). Wildlife scientists and public land managers have expressed concerns that new and existing electric transmission and distribution structures may be contributing alone or in concert with other stressors to impact sage-grouse and their habitat.

Currently, literature on the impacts to sage-grouse due to transmission lines is limited. Siting guidelines and stipulations for utility infrastructure in sage-grouse areas vary among state and federal agencies, as well as within federal agencies. The effectiveness of these siting guidelines and stipulations such as disturbance buffer distances (disturbance buffers) and seasonal construction or maintenance restrictions has not been adequately evaluated to date for power lines (Messmer et al. 2013). A recently published report by the U.S. Geological Survey (Manier et al. 2014) stated that "there is no single distance that is an appropriate buffer for all populations and habitats across the sage-grouse range." This document also noted the difficulty in assessing effects of tall structures due to limited research and confounding effects of other, co-located infrastructure. However, as more information has been obtained on buffer distances in general (e.g., Coates et al. 2013) and agency planning documents are updated, there have been recent efforts to provide consistency among different timing and distance restrictions in federal land use plans and among federal and state conservation management plans.

While electric utilities must comply with agency-specific buffers and stipulations, the BMPs in this document also differentiate types of utility work practices (e.g., by duration, frequency, level of activity, ground disturbance, etc.) and provide BMPs commensurate with the type of activity. For example, constructing a new transmission line would have greater potential impacts, and therefore require more comprehensive BMPs, than a line inspector driving an access road and scanning poles for damage with binoculars. Moreover, agency-developed buffers and stipulations are based on the energy industry as a whole and do not account for the differences in the nature and extent of electric utility activities from other energy industries (e.g., oil and gas, wind power).

[4] "Tall structures" may include power lines, communication towers, wind turbines, and other installations, excluding livestock fencing (Messmer et al. 2013).

In response to sage-grouse/power line concerns, uncertainties related to siting and permitting new lines, and variability in avoidance and minimization guidance, APLIC convened a group of utility and agency partners to develop best management practices (BMPs) that would aid in addressing the issues. Consequently, APLIC and its federal and state agency partners have prepared a suite of BMPs, contained herein, for the purposes of:

- Assisting electric utilities to avoid, minimize, and/or mitigate impacts[5] to sage-grouse and their habitats, that may result from the construction and O&M of new or existing electrical facilities on federal, state, and private lands.
- Providing a toolbox of techniques aimed at avoiding and minimizing impacts of power line projects to sage-grouse and their habitat.
- Providing a clearinghouse document that is specific to electric utility activities, how these activities may impact sage-grouse or their habitats, and BMPs targeted specifically to minimize impacts associated with these activities.
- Categorizing various types of O&M activities and providing guidance to determine levels of agency coordination that may be required before implementation.
- Maintaining a "living document" that can be referenced in other documents (e.g., state sage-grouse plans, Bureau of Land Management (BLM) and U.S. Forest Service (USFS) planning documents, utility rights-of-way (ROW) grants, etc.) and would be updated to reflect the best science available.

The BMPs presented and discussed herein are intended to provide consistent and implementable actions that comply with and enhance sage-grouse-specific conservation measures, recommendations, and requirements contained within federal and state management plans. Because each agency plan differs slightly in how power lines are addressed, this document refers the user to these agency plans for local, specific guidance rather than reiterating agency plan stipulations within these BMPs. Consequently, this BMP document does not identify specific numeric buffer distances related to electric utility activities; rather, it refers to agency plans which specify buffer distances for different locations, activities, and times of year. For example, the Wyoming Governor's Executive Order identifies different buffer distances based on whether an activity is in core or non-core habitat, and differentiates among transmission lines that use designated corridors versus new lines sited outside of corridors.[6] To ensure that utilities consult and comply with local, state, and federal sage-grouse plans, APLIC has directed users to these plans rather than include a range-wide "one size fits all" buffer in this document. Consequently, these BMPs are not intended to replace or conflict with existing agency plans, but rather provide additional detail and benefit specific to electric transmission and distribution infrastructure and related actions. APLIC encourages the use of, and reference to, these BMPs during permitting or

[5] These BMPs are intended to address both direct and indirect impacts. The term "impacts" is used throughout the document to collectively refer to both direct and indirect impacts.
[6] See http://governor.wy.gov/Documents/Sage%20Grouse%20Executive%20Order.pdf.

ROW grant renewal of electric facilities in conjunction with state and federal sage-grouse plans as well as APLIC's other avian protection guidance documents:

- *Avian Protection Plan Guidelines* (APLIC and USFWS 2005). To download, see http://www.aplic.org/uploads/files/2634/APPguidelines_final-draft_April 2005.pdf
- *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* *(*APLIC 2006*).* To download, see http://www.aplic.org/uploads/files/2643/SuggestedPractices2006(LR-2).pdf
- *Reducing Bird Collisions with Power Lines: The State of the Art in 2012* (APLIC 2012). To download, see http://www.aplic.org/uploads/files/11218/Reducing_Avian_Collisions_2012watermarkLR.pdf

These sage-grouse BMPs and the above referenced APLIC documents can serve as a "toolbox" from which a utility may select and tailor components applicable to its specific needs. APLIC further encourages utilities that operate in sage-grouse habitat to directly reference or incorporate these BMPs into their internal company procedures, such as utility Avian Protection Plans (APP).

The layout of this document is two-part:

- Sections 4 through 6 provide background information regarding electric utility construction, operations, the regulatory framework under which utilities operate, and a process to determine if routine maintenance activities can proceed in sage-grouse habitat with or without prior agency coordination (see Section 6.2.4). These sections establish the context in which the identified BMPs may be implemented; and
- Sections 7 through 9 present a summary of recommended BMPs for use in siting, permitting, constructing, operating, and maintaining new and existing power lines and associated infrastructure (e.g., access roads) to minimize impacts to sage-grouse and their habitat, potential compensatory mitigation measures, and links to state and federal agency sage-grouse plans.

3.1 Document Revisions

This is a "living document" and may be updated or revised as needed to reflect new science, techniques, resources, or regulatory requirements. APLIC members and agency partners will collaborate on future document updates and revisions. Utilities and agencies that implement the BMPs contained within this document are encouraged to evaluate the BMP effectiveness and communicate this information to APLIC, resource agencies, and utilities, thereby providing valuable information for future revisions of this document. BMP implementation and effectiveness will be an ongoing discussion topic within the APLIC sage-grouse working group, which meets at each APLIC business meeting (spring and fall annually).

4.0 BACKGROUND OF SAGE-GROUSE/POWER LINE EFFORTS

In 2010, the USFWS placed greater sage-grouse on the list of species that are candidates for protection under the Endangered Species Act (ESA) (United States Department of the Interior, 2010; Endangered and threatened wildlife and plants; 12 month findings for petitions to list the greater sage-grouse (*Centrocercus urophasianus*) as threatened or endangered, Federal Register 75:13910-13958). There are five criteria used for assessing listing decisions:

- Present or threatened destruction, modification, or curtailment of habitat or range
- Overuse for commercial, recreational, scientific or educational purposes
- Disease or predation
- Inadequacy of existing regulatory mechanisms
- Other natural or manmade factors affecting the species continued existence

The USFWS's finding determined that the two primary threats to greater sage-grouse are habitat destruction/modification and lack of sufficient regulatory mechanisms to protect the species. Approximately 60% of the extant habitat for greater sage-grouse occurs on federal lands.

Prior to the USFWS 2010 decision, the Western Association of Fish and Wildlife Agencies (WAFWA) convened a diverse group of stakeholders to identify problems and strategies to conserve sage-grouse. This forum developed the *Greater Sage-grouse Comprehensive Conservation Strategy* (2006) (Strategy), which recognized the need to assess the potential effect that tall structures may have on sage-grouse. The following four goals were identified in Appendix C, pages 29-31, of the Strategy document:

1. Compile and evaluate published research on the effects on sage-grouse due to impacts of existing tall structures.
2. Develop research protocols to conduct new studies to assess impacts of tall structures.
3. Develop scientific and consistent siting and operation and maintenance (O&M) criteria for tall structures in sage-grouse habitat to minimize negative impacts on sage-grouse.
4. Develop BMPs and appropriate mitigation measures to implement for siting and O&M activities associated with tall structures.

Achieving these goals and implementing the resulting BMPs would provide the USFWS with additional information for consideration in their reviews of the status and threat assessment of sage-grouse. APLIC's participating members and other entities recognized the need and value in accomplishing the WAFWA identified goals. Therefore, under the direction and support of WAFWA and its Executive Oversight Committee (EOC), Utah Division of Wildlife Resources (UDWR), Utah Wildlife in Need (UWIN) and its partners initiated an inclusive, consensus-based process to address and attain the four goals identified in the Strategy document.

In September 2010, with UWIN's publication, Contemporary Knowledge and Research Needs Regarding the Potential Effects of Tall Structures on Sage-grouse *(Centrocercus urophasianus* and *C. minimus*) [www.utahcbcp.org], **Goal 1** was addressed. The document reported, at that time, that no peer-reviewed, experimental studies either confirmed or denied the effects of tall structures on sage-grouse and that additional research is required to effectively evaluate/ascertain impacts. Utah State University (USU) is continuing to maintain a database of research on sage-grouse and tall structure impacts. Users of this BMP document are encouraged to visit the USU website (http://utahcbcp.org/htm/tall-structure-info/publication=12701) for the most current information.[7]

Since UWIN (2010), there have been several studies related to sage-grouse and tall structures either completed or in progress. Two studies in particular that have investigated sage-grouse and associated impacts from tall structures include: (1) the Falcon-Gondor transmission line study in Nevada (Nonne et al. 2013, Gibson et al. 2013), and (2) research in Wyoming on sage-grouse use of areas in proximity to wind facilities and associated transmission lines (LeBeau et al. 2014). In the Falcon-Gondor study, researchers found variable results regarding an effect of distance from the transmission line on sage-grouse demographics. This study found no support for an effect of distance from the transmission line on nest site selection and female nesting propensity, a small effect on male survival, and effects on nest and female survival associated with the quality of habitat. Some of the study sites in Nevada were impacted by fire and annual precipitation and subsequent impacts on habitat also influenced sage-grouse populations in this study. The authors of this final report caution limited interpretation from these results as they have not undergone peer review.

LeBeau et al. (2014) also found mixed results related to sage-grouse and tall structures (wind turbines and transmission lines). Specific to transmission lines, LeBeau et al. (2014) found that female sage-grouse survival and brood survival were not influenced by distance to transmission lines. The risk of nest failure in this study decreased in habitats closer to transmission lines, although this difference was not substantial. The authors noted that habitat strongly influenced sage-grouse occupancy. In 2013, the U.S. Geological Survey (USGS) released "Summary of Science, Activities, Programs, and Policies That Influence the Rangewide Conservation of Greater Sage-grouse (Centrocercus urophasianus)." The report summarizes some of the literature related to sage-grouse and power lines and concludes, "Whereas theoretical effects are clear and logical, information relating sage-grouse response to transmission lines and distribution lines, or the effects of these lines on sage-grouse demographics, is not extensive."

Given the small number of studies that are underway to date, and the differences in habitat at each of these sites, the research is still too preliminary to draw range-wide conclusions on level of impacts or seasonal disturbance buffer distances. Additional research is needed across varying

[7] This BMP document is not intended to be a literature review, since this was conducted by USU and they are updating and maintaining a database of current literature related to sage-grouse and tall structures. However, the authors of this BMP document will consider current research findings during updates of this document.

habitat types and different types of power lines (e.g., transmission vs. distribution lines, presence of access roads, etc) to develop better local or range wide impact assessments and appropriate conservation measures.

Following the publication of *Contemporary Knowledge and Research Needs Regarding the Potential Effects of Tall Structures on Sage-grouse (Centrocercus urophasianus and C. minimus)*, UWIN hosted a working seminar attended by sage-grouse researchers, statisticians, wildlife biologists, public and private land managers, and energy representatives to develop a study design protocol. Consequently, *Protocol for Investigating the Effects of Tall Structures on Sage-grouse (Centrocercus spp.) within Designated or Proposed Energy Corridors* ('Protocol') was published in July 2011 (www.utahcbcp.org). The Protocol is designed to assess impacts on sage-grouse from tall structures, particularly high voltage power lines, thereby accomplishing **Goal 2**. The Protocol recommends rigorous, replicated research based on a "Before-After-Control-Impact" (BACI) study approach to address three specific research questions:

1. Do sage-grouse avoid tall structures and if so, why?
2. Do tall structures increase avian predation by providing increased nesting and perching opportunities? If there is an increase in avian predation, is it significant to sage-grouse on a population level?
3. Do tall structures create fragmentation of habitat that limits use or movement of sage-grouse?

On September 13, 2011, the EOC adopted the Protocol as a minimum protocol for researching the impacts of electric transmission and distribution lines on sage-grouse populations and habitat (See Appendix B). Further, the EOC adopted a series of recommendations from the Range-wide Interagency Sage-grouse Conservation Team (RISCT) regarding participation in the studies, determining study sites and funding research opportunities by using a portion of an authorized project's "unknown impacts" sage-grouse compensatory mitigation budget. The EOC and RISCT support the need for additional research in order to provide data on a large geographical scale to inform management decisions. Discussions from this group concluded that direct impacts will require mitigation, but unknown, indirect impacts, could be researched in order to inform future mitigation opportunities.

Research that follows the Protocol is necessary to adequately address **Goal 3** (siting and O&M criteria) and **Goal 4** (BMPs). However, because of the long timeframe required to conduct multi-year BACI studies, the need for voluntary interim BMPs was identified for the electric utility industry by APLIC member utilities. In October 2012, APLIC convened a sage-grouse/power line meeting and invited representatives from electric utilities, environmental organizations, academia, state and federal agencies, and other interested stakeholders. The group agreed there was a need to develop electric utility-specific BMPs to assist utilities in avoiding and minimizing potential impacts to sage-grouse. This document is a result of this effort among participating utilities and agencies. Like APLIC's other guidance documents, these BMPs will be evaluated and updated as needed to reflect future research and best practices.

4.1 Regulatory Framework

The following provides a brief overview of some of the federal and state legislative and regulatory compliance laws and regulations that apply to electrical utilities and that must be followed during siting, design and construction of new facilities, continued operation of existing infrastructure or during routine or scheduled maintenance activities. These efforts reduce the risks of "take" of protected avian species or their habitat in violation of several federal acts. At times some of the required regulations or stipulations may conflict resulting in a utility conducting additional consultation to obtain a resolution.

4.1.1 Utility Operational and Reliability Requirements

Electric utilities are required to provide safe, reliable, and efficient electric service to their customers while maintaining the overall integrity of the regional electrical grid. Utilities' obligations to maintain safe, reliable, and efficient operation of the electrical system are directed through compliance with industry standard codes and practices. These efforts include upgrades of existing power lines and other facilities as well as constructing additional power lines and generating capacity (through new generation sources or by increasing capacity of existing lines) as necessary to meet customer needs. Electric utilities must also accommodate interconnections, e.g., to bring new renewable energy sources onto the transmission grid. The design, operation, and maintenance of electrical facilities (substations, transmission and distribution lines and other infrastructure) must meet or exceed applicable criteria and requirements outlined by the Federal Energy Regulatory Commission (FERC), North American Electric Reliability Corporation (NERC), Western Electricity Coordinating Council (WECC), Midwest Reliability Organization (MRO), National Electrical Safety Code (NESC), and the U.S. Department of Labor Occupation Safety and Health Administration (OSHA) standards for the safety and protection of employees, landowners, their property, and the general public.

A key factor in providing reliable electricity is regular inspection and maintenance of transmission and distribution lines, structures, and associated substations, access roads, fiber optics, etc. The Energy Policy Act of 2005 (ACT) established a process for establishing mandatory reliability standards for power lines and provided incentives to transmission companies to upgrade and maintain existing facilities and penalties for non-compliance. This Act expanded FERC's authority to impose mandatory reliability standards on the bulk transmission system. This legislation authorized the creation of an audited self-regulatory electric reliability organization, NERC, spanning North America, with FERC oversight in the United States. The Act states that compliance with reliability standards will be mandatory and enforceable.

Electric utilities are required to comply with the various reliability standards promulgated through the implementation of the NERC policies and procedures for their facilities regulated under NERC/FERC (230 kV or above as well as smaller voltages that are critical to grid reliability). Additionally, electric utilities operating transmission lines in the western U.S., often times in areas that encompass sage-grouse habitat, are subject to WECC and/or MRO standards that may be in addition to or more stringent than those currently required by NERC. State Public Service Commissions or local jurisdictions may also impose inspection and corrective maintenance requirements upon utilities doing business within their states (which may also include distribution facility requirements). In response, many electric utilities have prepared internal operation and maintenance policies and procedures designed to meet the requirements of NERC, WECC, MRO and the state public utility commissions, with respect to maintaining the reliability of their entire electrical system. The above regulatory requirements and others (e.g., state fire/fuels reduction programs, renewable energy mandates) may dictate utility actions that in some cases may conflict with wildlife or habitat conservation efforts. Such examples may include:

- Applying an acceptable level of separation between lines to protect against a catastrophic event (e.g., wildfire, windstorm, plane crash) versus co-locating lines within the same corridor.
- Co-locating transmission and distribution lines in an existing right-of-way may not always be feasible due to NESC standards, which identify necessary clearances for the safe and reliable operation of power lines.
- Conducting vegetation management (including during high fire risk periods) may overlap with bird nesting seasons, particularly in high elevation areas that may not be accessible due to deep snow cover during the nonbreeding season.
- Providing required service to customers that may be located in environmentally sensitive areas.
- Constructing new transmission lines to connect new renewable and conventional generation sources (often in remote areas) to load centers in urban areas can create new infrastructure in or across habitats that may be otherwise undisturbed.
- Responding to necessary emergency maintenance needs that occur during seasonal restrictions for sensitive wildlife species such as sage-grouse.

4.1.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) is a process that requires federal agencies to analyze the environmental impacts of their proposed action and their decision making process, and to fully inform the public of those impacts. The NEPA process is intended to help public officials make decisions that are based on the best available science and an understanding of potential environmental consequences, and then take actions that protect, restore, and enhance the environment. The NEPA process involves many steps, some of which are iterative, and includes identification of reasonable alternatives, design features (standard operating procedures, stipulations, and BMPs) and potential mitigation measures to reduce or avoid adverse impacts. The direct, indirect and cumulative impacts of the proposed action and alternatives are analyzed and the process results in a decision. Implementation of an action, including any mitigation and monitoring measures adopted, must be in accordance with the decision. The NEPA analysis may also include potential BMPs and mitigation measures to be implemented to avoid, minimize, or mitigate impacts to species and their habitats. Changes that are proposed must be consistent with and compatible with authorized uses and overall agency objectives.

The BLM and USFS are currently involved in the NEPA process to amend their resource and forest management plans to incorporate sage-grouse conservation measures. Changes to BLM Land Use Plans (LUP) and Resource Management Plans (RMPs) and U.S. Forest Service (USFS) Land and Resource Management Plans (LRMPs) require the agencies to review proposed changes through the NEPA process. This includes collecting public comment and reviewing the environmental impacts associated with the proposed changes in management. Analysis and disclosure of effects of a proposed action and its alternatives must be made available to the public.

The BLM LUPs are designed to provide guidance for future management actions. A proposal for use or development of resources on lands administered by BLM must be determined to be in conformance with the LUP. Similar to the BLM, the USFS approved or authorized actions must conform to the National Forest Management Act and the LRMPs. Both BLM and USFS incorporate Council on Environmental Quality (CEQ) regulations to comply with NEPA. For more information on CEQ, see https://www.fedcenter.gov/Bookmarks/index.cfm?id=786.

The BMPs presented and discussed herein are intended to provide recommendations that comply with and enhance sage-grouse specific conservation measures and requirements contained within federal and state management plans and NEPA documents. These sage-grouse BMPs and other APLIC documents can be referenced as guidelines from which a utility may select and tailor components applicable to its specific needs.

4.1.3 Endangered Species Act

The Endangered Species Act (ESA) (16 U.S.C. 1531-1544) was passed by Congress in 1973 to protect our nation’s native plants and animals that were in danger of becoming extinct and to conserve their habitats. The USFWS identified lack of adequate regulatory measures as a listing factor for greater sage-grouse. In order to address this issue, the federal land management agencies that have greater sage-grouse habitat are amending their land management planning documents. Federal agencies are directed to use their authority to conserve listed species, as well as “candidate” species, and to ensure that their actions do not jeopardize the existence of these species. The law is administered by two agencies, (1) the USFWS and (2) the Commerce Department’s National Marine Fisheries Service (NMFS). The USFWS has primary responsibility for terrestrial and freshwater organisms, while the NMFS has primary responsibility for marine life. Section 7 (a)(1) of the ESA charges Federal agencies to aid in the conservation of listed species, and section 7 (a)(2) requires the agencies, through consultation with the USFWS and/or NMFS, to ensure that their activities are not likely to jeopardize the continued existence of listed species or adversely modify designated critical habitats. These two agencies work with other federal agencies and/or project proponents to plan or modify projects with a federal nexus or connected actions to minimize impacts on listed species and their habitats. Protection is also achieved through partnerships with the states, with federal financial assistance, and a system of incentives that encourage state participation. The USFWS also works with private landowners by providing financial and technical land management assistance for the benefit of listed and other protected species. For more information on ESA, see http://www.fws.gov/laws/lawsdigest/esact.html.

4.1.4 Bald and Golden Eagle Protection Act

Under the authority of the Bald and Golden Eagle Protection Act of 1940 (BGEPA) (16 U.S.C. 668-668d) as administered by the USFWS, bald (*Haliaeetus leucocephalus*) and golden (*Aquila chrysaetos*) eagles are afforded additional legal protection (both species are also protected under the Migratory Bird Treaty Act [MBTA], see below). *Take* under BGEPA is prohibited unless permitted, and defined as "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." "Disturb" under BGEPA is defined in regulation as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." For more information on BGEPA, see http://www.fws.gov/laws/lawsdigest/baldegl.html.

4.1.5 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (MBTA) (16 U.S.C. 703-712), administered by USFWS, is the legal cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties that provide international protection for migratory birds. It is a strict liability statute meaning that proof of intent is not required in the prosecution of a "*taking*" violation. Most actions that result in *taking* or possessing (permanently or temporarily) a protected species can be violations.

The MBTA states: "Unless and except as permitted by regulations… it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill… posses, offer for sale, sell…purchase…ship, export, import…transport or cause to be transported…any migratory bird, any part, nest, eggs, of any such bird, or any product… composed in whole or in part, of any such bird or any part, nest, or egg thereof…" Unlike BGEPA, there is no disturbance clause in the MBTA (disturbance that does not result in a "take" is not unlawful under MBTA).

A 1972 amendment to the MBTA provided legal protection to birds of prey (e.g., eagles, hawks, falcons, owls) and corvids (e.g., crows, ravens). The MBTA currently protects 1,026 migratory bird species, including waterfowl, shorebirds, seabirds, wading birds, raptors and songbirds. The MBTA protects most birds native to North America, and excludes house sparrows (P*asser domesticus*), European starlings (*Sturnus vulgaris*), rock doves (*Columba livia*), any other species published in the Federal Register, and non-migratory upland game birds, such as sage-grouse. Sage-grouse are not protected by the MBTA; however avian predators of sage-grouse are protected. See http://www.fws.gov/laws/lawsdigest/migtrea.html for more information on MBTA.

4.2 Overview of Sage-grouse Ecology

The greater sage-grouse is the largest grouse in North America and is a sagebrush (*Artemisia* spp.) obligate species (Patterson 1952). The sage-grouse belongs to the order Galliformes, and the family Phasianidae, which includes grouse, partridges, pheasants, ptarmigan, quail, and turkeys. It is a member of the Tetraoninae subfamily and the Centrocercus genus, which includes the Gunnison sage-grouse.

Population estimates of sage-grouse have declined 17 to 47% across their range (Connelly and Braun 1997). Sage-grouse occupy approximately 56% (670,000 km^2) of their potential pre-settlement range, which once covered approximately 1,200,000 km^2 (Schroeder et al. 2004). This decrease has been attributed to the fragmentation, degradation, and loss of the original sagebrush habitats (Braun 1998). The species is currently found in 11 states and 2 Canadian provinces (Connelly et al. 2004).

Sage-grouse breed on traditional display sites called leks (Patterson 1952). Sage-grouse are polygynous; females attend leks where the males display and males copulate with multiple females. Subsequently, females nest, incubate, and raise the broods on their own (Bergerud 1988). After breeding, females typically move from 1.1 to 6.2 km from the lek to a nest site (Connelly et al. 2000, Peterson 1980, Wakkinen et al. 1992, Schroeder et al. 1999, Wiechman 2013). This breeding and nesting habitat can greatly affect population dynamics such as nest initiation rates, clutch size, and reproductive success, based on the condition and diversity of the vegetation (Barnett and Crawford 1994, Coggins 1998). Fluctuations in annual precipitation influence vegetation communities, which can in turn affect sage-grouse populations from year to year (Coggins 1998).

The date of nest initiation varies from late March to early June, depending on elevation, and other environmental factors (Schroeder et al. 1999). Clutch size can include up to 10 eggs, with a mean clutch size of 7.5 and 7.1 in the eastern and western portions of the range, respectively (Schroeder et al. 1999). Clutch size is typically higher for adults than yearlings across the range (Wallestad and Pyrah 1974, Peterson 1980, Hausleitner 2003). Incubation typically lasts 27 days (range is 25 to 29 days) beginning after the last egg is laid (Patterson 1952, Schroeder 1997). Nest success varies across the range from 15-86% with higher nesting success occurring in stable populations (Schroeder et al. 1999). Sage-grouse typically nest in areas dominated by big sagebrush and relatively thick vegetative cover (Patterson 1952, Gregg et al. 1994) with greater success occurring in areas with greater canopy cover (Wallestad and Pyrah 1974, Gregg 1991). In addition to vertical and horizontal structural diversity (Wakkinen 1990, Gregg 1991, Schroeder et al. 1999, Connelly et al. 2000), grass height and cover are important factors in nest site selection (Connelly et al. 2000, Kolada et al. 2009) and nest success (Gregg et al. 1994, Hausleitner 2003).

Habitat used by successful broods for up to three weeks post-hatching are defined as early brood-rearing habitats (Connelly et al. 2000). Early brood-rearing habitat is also characterized by a relative abundance of forbs and insects as food for females and chicks (Drut et al. 1994, Apa 1998, Connelly et al. 2000). In late summer, as vegetation and habitat dries out, sage-grouse will move to more mesic areas (Fischer et al. 1996, Schroeder et al. 1999, Connelly et al. 2000, Braun et al. 2005), with enough moisture to maintain forbs throughout the summer (Fischer et al. 1996, Hausleitner 2003).

As fall transitions to winter, the diet of sage-grouse is dominated by sagebrush leaves, providing >99% of the food eaten (Patterson 1952). Several factors influence sage-grouse habitat selection during winter, including snow depth and hardness, topography, and vegetation height and cover (Beck 1977, Schoenberg 1982, Robertson 1991, Schroeder et al. 1999). Sage-grouse may select wintering areas with sagebrush canopy cover varying from 6–43% (Schroeder et al. 1999), but typically choose canopy cover between 10–25% (Wallestad 1975, Robertson 1991, Connelly et al. 2000, Braun et al. 2005). As winter ends, sage-grouse flocks move towards breeding habitat that may be near or far from wintering ranges (Connelly et al. 2000). Although sage-grouse may have distinct seasonal ranges, some populations may have seasonal ranges that overlap or may be integrated (i.e., winter range may overlap or be near active leks; Connelly et al. 2000).

4.3 Overview of Power Line Infrastructure and Terminology

Figure 1 shows a schematic of a power system from generation to customer (from APLIC 2006). Power is taken from a generation source and transmitted via ***transmission*** lines to substations where voltages are lowered. The power is then distributed via ***distribution*** lines to service homes, business, and industry.

Power lines are rated and categorized, in part, by the voltage levels to which they are energized. Because the magnitudes of voltage used by the power industry are large, voltage is often specified with the unit of kilovolt (kV) where 1 kV is equal to 1,000 volts (v). In addition to the voltage level, power line classification is dependent on the purpose the line serves (see Figure 2). See Appendix C for example photos of different power line configurations.

A power line’s voltage, configuration, conductor design and spacing, location, and structure type are determined by the present and anticipated power demands or load requirements the line will serve. For example, if a customer in an agricultural area requested service for a new irrigation pump, a distribution line may be necessary. If more energy is needed to meet the increasing electricity demands of a growing population center, a transmission line may be required to bring power to the load center, sometimes across great distances. During the siting and designing of new or upgraded power lines and associated features, existing biological, cultural, visual, land use, land ownership, land management, local, state, and federal regulatory agency guidelines, engineering, and reliability factors are considered in order to determine the best route.

Figure 1. Schematic of a Power System from Generation to Customer (from APLIC 2006)

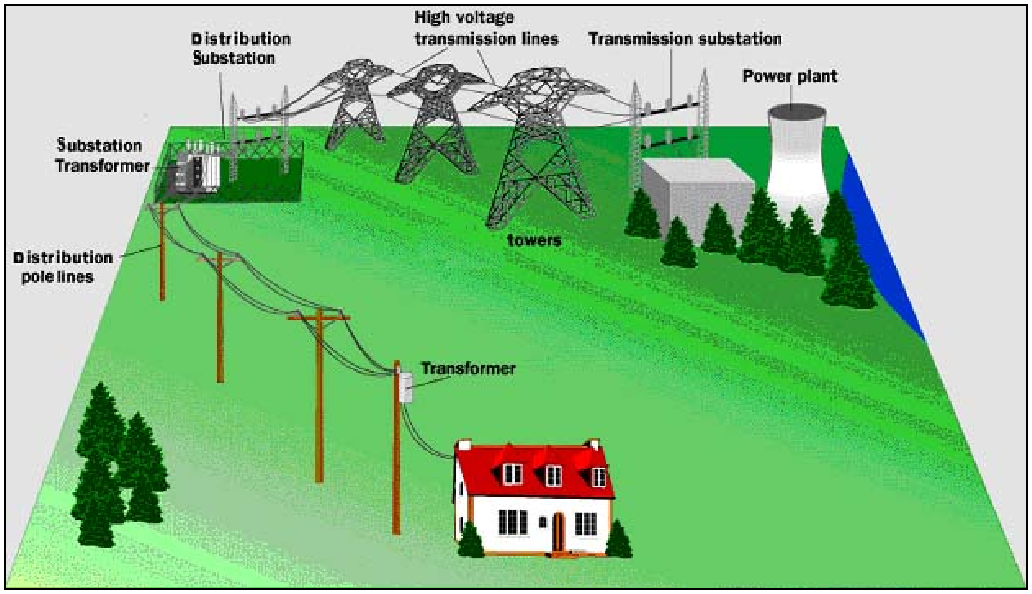


Figure 2. Typical Voltage Ranges of Different Power Line Classes

Designation	Voltage Range
Generation plant	12V to 22kV
High Voltage Transmission	345kV to 700+ kV
Transmission	115kV to 230kV
Sub-transmission	46kV to 69kV
Distribution	2.4kV to 35kV
Utilization	120V to 600V

ROW widths vary based on requirements for different power line voltage ratings and clearances that are generally determined by engineering and reliability standards, state statues, and NESC. ROW widths are also a function of the structure design, span length, conductor to ground clearances and the conductor sag. ROW widths for transmission lines vary from 50 feet to more than 250 feet. The higher the voltage, the greater the ROW width required for the safe operation of the line. ROW widths for distribution lines typically vary between 30 feet and 40 feet. New ROW permits can be increasingly challenging to obtain; as a result it is a common practice to rebuild an existing line at a higher voltage in an existing ROW when engineering, reliability and safety considerations allow. In such cases, additional ROW width may need to be secured to accommodate the higher voltage.

Electric utilities install power lines either overhead or underground depending upon numerous considerations. Some key factors include customer needs, costs, code requirements, individual utility policies, terrain, voltage, and technological, land use, and environmental restrictions.

Electric utilities have a legal obligation to ensure the provision of safe, reliable, and efficient service at the lowest or reasonable cost possible as mandated by each state (Consumers Service Guide); see http://www.consumerservicesguide.org/resources/national/browse/category/238/. Appendix A contains a more detailed discussion of underground power line considerations. Founded in 1889, the National Association of Regulatory Utility Commissioners (NARUC) is a non-profit organization with members in all fifty states dedicated to representing the State public service commissions who regulate the utilities that provide essential services such as energy, telecommunications, water, and transportation. NARUC's members have an obligation to ensure the establishment and maintenance of utility services as may be required by law and to ensure that such services are provided at rates and conditions that are fair, reasonable and nondiscriminatory for all consumers.

4.4 Siting and Routing Considerations

Siting and preparation for routing new power lines requires an open and comprehensive process that balances various factors including electric (power) system planning, the natural, human, and cultural environment, public input, local, state, and federal regulatory requirements such as those outlined under NERC/FERC, resource objectives, land rights, land use, economics and engineering. The utility must select a route that minimizes overall impacts to the greatest extent feasible while still complying with federal reliability requirements, resource agency objectives, environmental regulations, and landowner concerns, local land use planning objectives, and reducing financial liabilities and costs to ratepayers or members.

Specific siting requirements depend on siting authorities, location, voltage, and length of the power line. There are times when no environmental regulatory requirements may apply to power line siting. This could occur if the power line being sited involves urban areas, lower voltages, short span additions, or for projects without a federal nexus or state siting authority. In regard to sage-grouse, there is a potential that power lines could be sited within designated sage-grouse habitat.[8] Areas outside of designated sage-grouse habitat may be identified as an opportunity for siting a new transmission line. These areas may or may not require conservation measures, dependent on regulatory requirements. BMPs outlined in this document could be implemented in these areas to minimize impacts to sage-grouse and their habitats. Conservation measures may still be required or recommended in non-designated habitats, or adopted proactively by utilities. Ultimately, utilities will follow the federal, state and local siting requirements and consultation

[8] For the purposes of this document, “designated” sage-grouse habitat includes the highest priority habitat designation identified at the federal or state level. This may include “core” habitat, “priority” habitat, “PACs,” and “delineated WCAs.” The term “designated” sage-grouse habitat, as used in this document, is not intended to include “general” habitat or “non-core” habitat.

processes, as applicable, for siting power lines to avoid and minimize impacts to sage-grouse in areas where these stipulations apply as well as adopt other conservation measures such as implementation of BMPs as appropriate. These BMPs will provide a benefit to sage-grouse regardless of land ownership and/or habitat designation.

Federal and state agencies have identified re-routing of existing facilities outside of designated sage-grouse habitats as a conservation measure. Environmental and community concerns, land use, and costs should be considered in a line re-routing analysis. Other resources such as federally listed plants and wildlife, state listed sensitive species, view sheds, cultural resources, wetlands and riparian corridors, and other factors must be taken into consideration when evaluating re-routes of existing infrastructure.

4.5 Considerations for Upgrading or Operating Existing Power Lines and Features

Utilities may upgrade existing facilities to increase energy transmission efficiency, reduce environmental and land use impacts, and reduce costs from creating and acquiring a new transmission or distribution line ROW. It is important to incorporate BMPs such as seasonal buffers and timing restrictions early in the upgrade planning process to avoid and minimize activities in sage-grouse habitats at crucial times (breeding and nesting) to the extent possible. However, utilities may have limited flexibility when upgrading an existing line if the line is not being relocated. Efforts to reduce disturbance during O&M activities are also effective ways to minimize impacts to sage-grouse.

Often times, existing facilities have access roads or a historic road network that can be used during upgrading and O&M activities; this reduces the need to create new roads and minimizes disturbance to sage-grouse habitats. Early on in the planning process for upgrades and O&M activities, utilities can identify existing roads and disturbed areas, if available, for staging and other temporary uses.

5.0 UTILITY CONSTRUCTION ACTIVITIES

Construction of power lines is a sequenced and planned process with timing goals, specific construction practices, and proactive measures to reduce power line footprints on the ecological landscape. Depending on the type of line being constructed, there are several different construction practices that a utility undertakes. For a video demonstrating high voltage transmission line construction, see http://www.gatewaywestproject.com/construction.aspx. Lines are often constructed in segments and depending on the length, type, and configuration of the line/structures there could be multiple crews working at different times or on different line segments. Typically, crews are assigned specific tasks and work their way along the ROW. For example, a crew may be responsible for drilling pole holes. They would drill pole or foundation holes along the length of the ROW and another crew would follow pouring foundations if needed and assembling and erecting structures. Once a sufficient number of structures have been erected, another crew would start stringing and tensioning the lines or conductors. This type of construction often results in periods of high activity at a particular location followed by periods of low to no activity as crews proceed in this sequence along the right of way. The following provides examples of the various stages of construction sequencing.

Site Preparation

- When building a power line, a typical construction sequence begins with building access roads and pad sites as needed, throughout the corridor to construct the power line and provide access to conduct maintenance during the life of the line. Access road size generally depends on the largest piece of equipment that would travel on the road during construction. Second in the construction phase is site preparation, and constructing staging areas and substation sites, which also require access. During the processes, erosion and sediment are controlled by installing water bars, wattles/silt fences, culverts, sediment basins or other appropriate controls in order to reduce impacts to water quality and water resources, including wetlands.
- As part of preconstruction activities, the utility/contractor would perform a geologic assessment to evaluate potential geologic and geotechnical hazards and design the project to avoid and minimize potential geotechnical risks such as slope failure, unstable soils, and landslide risks. In addition, a geotechnical investigation would determine required type of foundations and excavation needs.
- If conditions require blasting a blasting plan would be developed, which would identify methods and BMPs to minimize the effects of blasting, where applicable.

Construction of Structure Foundations

- Construction of power pole foundations differ depending on the type of structure and soil conditions. Assembling high voltage structures typically involves delivery of components for each wood or steel structure by a flatbed truck with assembly performed onsite. As construction takes place, a crane moves along the ROW to set each structure in place, and in some cases, a helicopter may be used.

- Foundation excavations may be performed using various diameter augers in sandy or clay soils with limited rock, slurry excavation in wet areas or with soft caving soils or a combination of blasting and drilling in rocky terrain.
- Factors that determine whether blasting is necessary are the geology of the area and the hardness of the rock. Holes are drilled in the rock with pneumatic drills to allow insertion of an explosive charge. Holes are drilled in a pre-determined pattern in order to insert explosive charges and control the blast and fly-rock as appropriate. Implementing controlled blasting limits the physical breaking or cracking of the rock to minimize stressing and fracturing of the rock beyond the limits of excavation. Controlled blasting typically does not generate ground vibrations that are perceptible beyond, at most, a few meters from the blast location.
- Foundations are generally required for steel structures. Typical foundations are made of steel reinforced concrete piers. The foundation diameter and number of foundations needed for a structure vary depending upon structure type. For example, some steel lattice structures require four foundations (one for each “leg” of the structure) that are generally four feet in diameter and 15 feet deep, though these numbers may vary dependent on the soil or rock type at each site and the size of the structure. Tubular steel structures require auguring a large diameter foundation hole to accommodate the reinforced steel anchor bolt cages. The steel cages are installed after excavation of the foundation holes and before concrete placement to strengthen the foundation’s structural integrity. Concrete foundations typically extend about two feet above the ground.

Structure Assembly

- Steel lattice structures are assembled in sections using a truck-mounted crane or similar equipment, and then lifted onto the foundation using a large crane specifically designed for tower construction.
- Construction of wood pole structures (such as H-frames or wood monopoles) typically requires auguring a hole so poles can be embedded in the soil and does not require a foundation. The hole is augured, to a depth equaling about 10% of the overall height of the pole plus two feet. Wood structures (e.g., single pole and H-frame) are framed on the ground at the structure site and set in place by a truck-mounted crane. The wood pole is placed within the hole and soils or crushed rock is backfilled around the base of the pole and compacted.

Wire Pulling

- Once structures are in place, the line, or conductor, is strung. Temporary pulling work sites are set up for the equipment used to pull and tighten the conductor. The spacing of these along a line depends upon the span length, size of the conductor, and length of conductor on a reel. A specialized wire-stringing vehicle is attached to the line to pull it through, followed by tightening or tensioning the line to achieve the correct sagging of the conductor wire between support structures.

Construction duration varies greatly depending on several influencing factors such as structure design, access needs, ease of access, amount of site preparation required (vegetation cutting or removal), project length, availability of materials and construction equipment, availability of construction resources (crews/contractors), and ROW grant or environmental/land use restrictions. The length of the project can be an important influencing factor in determining the duration of construction. Projects of longer distances can experience faster construction rates on a per mile basis if the construction contractor uses more crews to construct the project. Figure 3 shows examples of construction durations for typical distribution, transmission, and high voltage transmission lines in flat sagebrush terrain. Actual construction durations may vary from the typical durations/examples presented. In order to estimate durations on a per mile basis, typical project lengths were assumed (Project Length column of Figure 3). For example, as presented in Figure 3, a 50-mile length of high voltage transmission line may be constructed at a pace of 1-2 weeks per mile. In contrast, a 5-mile distribution line may be constructed at 2-3 weeks per mile since fewer construction resources (construction crews) may be used.

Figure 3. Example Durations for Construction of Power Lines

Voltage Classification	Project Length	Structure Type	Terrain	Duration per Mile
Distribution	5 miles	Single wood pole	Flat, sagebrush	2-3 weeks per mile
Transmission	20 miles	Single or double wood pole(s)	Flat, sagebrush	2-2.5 weeks per mile
High Voltage Transmission	50 miles	Steel structure with foundation(s)	Flat, sagebrush	1-2 weeks per mile

Equipment used during construction will vary depending upon the voltage class, but may include the following types of equipment: 4-wheel drive trucks, material (flatbed) truck, bucket truck (low reach), boom truck (high reach), man lift, backhoe, excavator, bulldozer, pulling and tensioning equipment, truck or track mounted auger, truck-mounted crane, track-mounted crane or specialized crane.

Only the area required to construct the power line in a safe and efficient manner should be disturbed (construction footprint). Typically, the construction footprint may be larger than the operational footprint (permanent area needed for operations). Temporary use areas are required to stage materials, set up pulling equipment, and for some projects, helicopter landing locations. These areas should be sited in previously disturbed areas to minimize impacts. Because pulling and tensioning equipment needs to be operated in a straight line, sites are typically utilized outside of the permanent ROW where the line changes direction. Utilities have some flexibility in determining pulling and tensioning locations, but locations are dependent on the amount of conductor on a spool, line angles and if one or two spools will be pulled at one time. Disturbed areas around the structures and temporary work areas are restored and re-vegetated post construction, as required by the property owner or land management agency. All practical means are used to return land to its original contour and natural drainage patterns along the right of way where feasible. However, utilities may not re-vegetate within a 10 to 20-foot diameter circle around wood poles to protect them from range fires. Also, areas around structures may not be fully re-contoured in order to maintain access and level area to facilitate maintenance, which may include maintenance on live line (power line is energized during maintenance).

6.0 UTILITY MAINTENANCE ACTIVITIES

Federal land managers administer ROW grants and issue easements on federal lands for construction, operation, and maintenance of power lines under the Federal Land Policy and Management Act (FLPMA) and will identify terms and conditions, right of use or designation of access routes to the ROW, and the right of the permittee to maintain and operate its facilities. In many cases, a utility's ROW grants, easements, or special use permits authorize the construction, operation, and maintenance of an "Electric Power Line" and authorize access to the power line and ROW.

6.1 Access Requirements

Many utilities have ROW grants issued prior to the enactment of FLPMA, and these grants may or may not be clear on right of use or designation of access routes to existing power lines. However, the right to maintain and operate is either directly expressed or implicitly understood in each grant or easement. Most federal land managers recognize the need for a utility to access its power lines since the operation, maintenance, and emergency repair of the power lines cannot be accomplished without reasonable access for vehicles and personnel. In most situations, this can be accomplished by using historical or existing roads and trails used during original line construction (sometimes >40 years ago) but in some cases, the use of overland travel or improvement to historical access routes is required. The current condition of power line access roads varies greatly between utilities and across geographic areas: some existing roads may be adequate for routine line maintenance activities, while in some situations there may be a need for seasonal or occasional access road maintenance or improvements (generally site-specific activities). Maintenance activities on access roads is not conducted without the authorization of the land managing agency or private landowner unless in response to emergencies or otherwise authorized in the existing grant or easement. In many districts, the BLM and USFS have or are currently revising their Travel Management Plans and it is crucial that access to utility infrastructure is evaluated and considered in the revised plans.

Most land management plans and ROWs restrict the use of vehicles under poor weather conditions when ruts may result from vehicles in wet soils, seasonally in areas of sensitive resources such as occupied sage-grouse habitat, or in special management areas. APLIC members have power lines that serve facilities within areas that are managed for special resources or have power lines within or adjacent to sage-grouse habitat. Because utilities must have access to inspect or repair their structures and facilities in these sensitive areas, this document includes BMPs to minimize impacts to these habitats or sensitive areas.

In the event of an emergency, a utility must respond as quickly as possible to address safety issues and restore power; this may require actions beyond those routine actions authorized in ROW grant(s) and/or easements. This may include travel outside of designated access roads, construction of new access routes, or improving access roads without prior review or approvals.

The land manager or landowner would be notified of the emergency and actions taken in concurrence with the utility responding to the emergency. The utility and resource agencies or landowner would then work together to identify and implement appropriate restoration or remedial measures after the emergency has been addressed. Establishing access roads, pad sites, and other work areas that can be used in both routine and emergency situations in cooperation with land managers and land owners is a way to proactively reduce impacts and ensure crews can stay within authorized power line and access ROWs.

6.2 Maintenance Requirements

Electric utilities are required to provide safe, reliable, and efficient electric service to their customers while maintaining the overall integrity of the regional electrical grid. A key factor in providing reliable electricity is regular inspection and maintenance of transmission and distribution lines, structures, and associated substations, access roads, fiber optics, etc. The Energy Policy Act of 2005 established a process for establishing mandatory reliability standards for power lines and provided incentives to transmission companies to upgrade and maintain existing facilities and penalties for non-compliance.

Field maintenance activities may include the following three categories, each of which is detailed in subsequent sections:

- Routine maintenance (inspections, corrective actions, and vegetation management) (See 6.2.1)
- Major corrective actions (See 6.2.2)
- Emergency activities (See 6.2.3)

6.2.1 Routine Maintenance and Inspections

Routine inspection and maintenance activities are ordinary maintenance tasks (see Figure 4) that have historically been performed and are regularly carried out on a routine basis within the bounds of the existing power line and access road ROW authorizations. These actions generally would not require new ground disturbances within the ROW unless needed for access or to set up equipment in a safe position around the pole. If any ground disturbance takes place, it is within the existing ROW and construction footprint (areas previously disturbed). Because these actions are considered authorized under the existing ROW grant, they generally do not need additional land manager or agency approvals unless there is a federally listed species or eligible cultural resources in proximity to the work area. Utilities should check with their local ROW grants to identify terms and conditions associated with grants. If there are any potential concerns or questions regarding what actions are allowable under the existing ROW or permit, the utility should coordinate early with the authorizing agency.

Safety Inspection

Utilities are required to perform safety inspections of their power lines on a cycle that can vary from multiple times per year to every few years. Inspection frequency, which is dependent on location and voltage, is dictated by utility regulatory agencies. Inspections are performed by an inspector via a 4-wheel drive pickup, 4-wheel drive all-terrain vehicle (ATV), or from the air via a helicopter or fixed wing aircraft. In some cases, the inspector walks the ROW. The inspector assesses the condition of the power line structures, conductors, and hardware to determine if any components need repair or replacement, or if other conditions exist that require maintenance or modification. The inspector could also note any encroachments on the ROW that could constitute a safety hazard or are unauthorized. The inspector accesses observation locations along each line and uses binoculars and/or spotting scopes to perform this inspection.

Detailed Inspection

Detailed inspections of an electric utility’s transmission and distribution facilities occur on cycles determined by federal reliability standards, state requirements, and the utility’s internal operating procedures. The inspector will access each structure on the identified line and check all equipment and other components to determine if repairs or maintenance activities are required. Inspectors performing this work would use conventional 4-wheel drive trucks, 4-wheel drive ATVs, or snowcats, or the inspector may walk the line. Inspectors may view the line using binoculars (aerial and ground inspections) and/or spotting scopes (ground inspections). Helicopters or airplanes are used to conduct aerial inspections, but are typically not used for detailed inspections. Due to their costs, aerial inspections are often limited to transmission lines in remote areas or with rugged terrain. Aerial inspections help identify the locations where detailed inspections are necessary, and can minimize inspection needs on the ground in sage-grouse habitat if no concerns are observed during aerial inspections. Minor repairs to structures might also be done during detailed ground inspections.

Figure 4. Examples of Routine Maintenance Activities

Activity	Description	Equipment	Frequency/ Duration
Inspections			
Aerial Inspection	Visual inspection of lines and poles to detect any safety or operational problems and nests on structures	Helicopter or fixed wing aircraft	Annual or semi-annual/Day(s) for a line, minutes per each structure
Ground Inspection	Visual and physical inspection of lines and poles to detect any problems	ATV 4wd truck	Semi-annual or annual/Day(s) for a line, minutes per each structure
Maintenance			
Access Road Maintenance	Removal of access road obstructions (e.g., rocks, vegetation, downed trees)	4-wd truck, back hoe	As needed/Day(s)
Guy Wire Tightening	Tightening guy wires	Bucket truck or boom truck	As needed/Day(s)
Problem Bird Nest Management	Addressing bird nests that pose a fire threat, hazard to the bird or potential power outage. Actions may include nest removal or relocation, nest platform installation, and/or pole modifications to discourage re-nesting[9]	Bucket truck or boom truck	When problem nests are identified/Hours or Day(s)
Crossarm Replacement	Installing new crossarm on pole	Bucket truck or boom truck	As needed/Hours
Crossarm Reframing	Lowering crossarm to obtain avian-safe separations[10]	Bucket truck or boom truck	As needed/Hours
Hardware Tightening	Tighten existing hardware on structure	Boom truck or bucket truck	As needed/Hours
Anchor Replacement	Installation of new anchor	4-wd truck, back hoe	As needed/Days
Insulator	Replacement of an insulator upon	Bucket truck or	As needed/Hours or

[9] See APLIC (2006) for more details on management of nests on utility structures and associated permitting requirements.
[10] See APLIC (2006 and 2012) for additional information on preventing avian electrocutions and collisions with power lines.

Activity	Description	Equipment	Frequency/ Duration
Replacement or Conductor Repair	failure or repair of a broken conductor	boom truck	Day(s)
Installing Bird Protection Measures	Installing protective covers, line markers or other devices intended to minimize electrocutions or collisions[11]	Bucket truck or boom truck	When problem structures are identified/Hour(s) or Day(s)
Pole Testing and Treatment	Taking core samples from poles and treating poles with chemical preservative	ATV 4-wd truck	Day(s) to week(s)[12] for a line and minutes per pole
Pole Replacement	Individual pole replacement in same location	Bucket truck or boom truck, backhoe for rocky areas	When problem structures are identified/Day(s)
Vegetation Management	Pruning or clearing of undesirable vegetation and danger trees[13] from ROW and hazard trees that are within the ROW or adjacent to the ROW	ATV, 4-wd truck, bucket truck, chainsaws, mower or sprayer (herbicide use)	Day(s) to week(s) for a line and typically minutes to hour(s) for an area
Cathodic Protection	Inspection and replacement of anodes or protection equipment	4-wd truck, backhoe	Day(s) to week(s) for a line; partial day per structure

Outage Cause Inspection

In the event of an outage or interruption in the transmission and distribution of electricity on power lines, a utility will typically conduct an inspection (aerial or ground) to determine the cause of the interruption. Outage cause inspections use similar equipment and points of access as the other above listed routine inspections. In addition, trouble trucks (typically a 4-wheel drive truck with a personnel bucket to lift employees to the pole) are used to gain access to the pole for a lineman to determine the cause of the outage. Depending on the type of repair work needed and a utility's safety requirements, work may be done by a single troubleman or crew(s) may be

[11] See APLIC (2006 and 2012) for additional information on preventing avian electrocutions and collisions with power lines.
[12] Cycle dependent upon area. See section 6.2.1 for discussion of routine maintenance cycles.
[13] Danger and hazard trees as defined in American National Standards Institute (ANSI) A300.

needed. The type of repairs and needed crew compliment will dictate the number and type of vehicles used. This inspection may take place at any time of the day or night and could result in emergency repairs.

Corrective Routine Maintenance

Corrective routine maintenance activities are ordinary maintenance tasks historically performed and carried out on a regular basis and generally authorized under the ROW grant through the BLM, private easements, or a Special Use Permit with the USFS. The work performed is typically repair or replacement of individual components, performed by a relatively small crew using a minimum of necessary equipment, and usually conducted within a period from a few hours up to a few days. Work requires access to the damaged portion of the line to allow for a safe and efficient repair of the facility. Equipment required for this work may include a 4-wheel drive truck, material (flatbed) truck, bucket truck (low reach), boom truck (high reach), excavator, or man lift. This work is scheduled and is typically required due to issues found during inspections. For non-emergency or non-urgent repairs, timing or seasonal restrictions would be considered when scheduling this work in designated sage-grouse habitat (see BMP section).

Wood Pole Test and Treat

Many utilities have a wood pole test and treat program where each pole might be tested on a five-to 20-year cycle. This program includes hand excavating around the wood pole, completing a detailed inspection of the wood pole at the ground line (to determine extent of wood rot) and re-treating that portion of the wood pole if necessary. Core samples from the wood pole may also be taken, and poles may be treated with an approved chemical preservative. Access to structures is with four-wheel drive trucks or 4-wheel drive ATV’s. Associated work included in the detailed inspection may also be performed at this time. Impacts are limited to the area around the poles and would occur entirely within the permitted ROW.

Vegetation Management

The objective of a utility's Vegetation Management Program (VMP) is to manage vegetation in order to prevent threats to the safe and reliable operation of its system and the electric grid. These threats include trees that could grow-in, fall-in, or blow into the power line. Utilities manage vegetation in a cost effective and environmentally conscientious manner, and within the stipulations outlined in permits, grants, and easement documents. Vegetation management may occur as emergency response to remove branches or trees fallen on power lines (e.g., during storms), and as routine maintenance of existing power line ROWs or permits. While vegetation management is often conducted year-round in some areas, there may be extenuating factors that influence the seasonality of vegetation management in other areas. For example, in some high elevation areas, deep snow cover and steep terrain may preclude routine vegetation management during the winter months due to safety and access constraints. State fire stipulations may also require vegetation management on lines 200kV and larger in high fire risk areas during wildfire danger periods (e.g., during the spring or summer months).

Some utilities use the integrated vegetation management (IVM) technique to remove trees and manage undesirable vegetation (e.g., tall, fast growing species). The goal of IVM on utility ROWs is to establish sustainable stable, low-growing plant communities that are compatible with power lines and discourage undesirable tall vegetation that could pose potential safety, access, fuel loading/fire danger, or reliability problems. IVM requires a combination of manual, mechanical and herbicide control methods. Equipment and materials will vary with each control method selected and site-specific conditions. Utilities require access to and along the entire power line ROW when conducting vegetation management. In some cases temporary access off the approved ROW or permit may be needed.

With proper IVM, the low-growing vegetation can eventually dominate the right-of-way, inhibit tall-growing vegetation or incompatible species, and reduce the need for future treatments. Establishing native vegetation will also reduce the occurrence of noxious or invasive weeds into the corridor, and can help reduce the risk of fire.

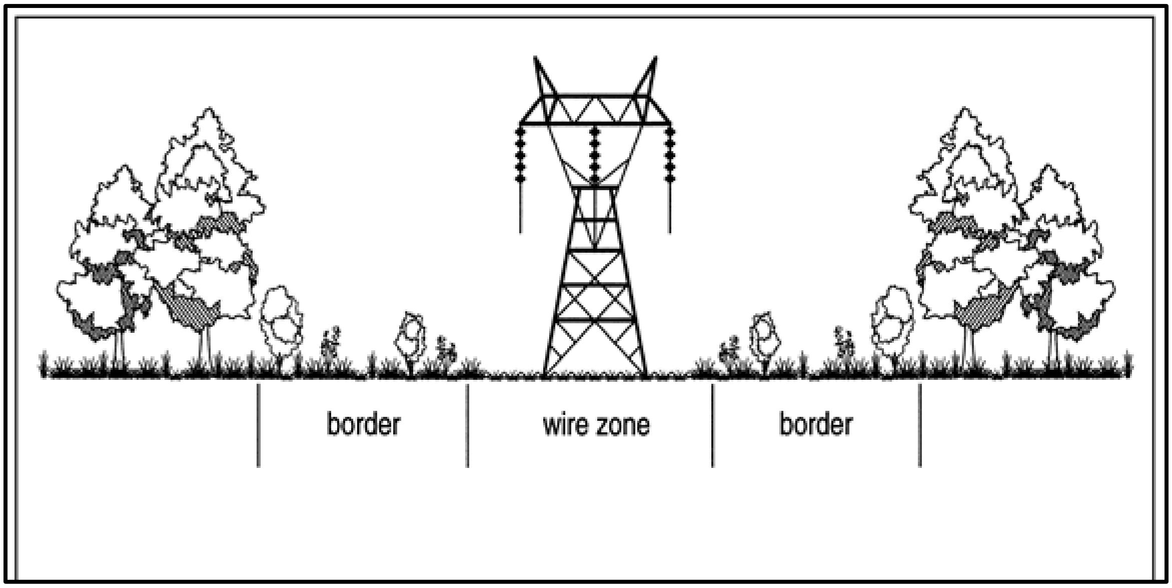
IVM techniques include but are not limited to:

- Manual and mechanical cutting, where wood debris is left on site to enrich the soil. Use of hand-operated power tools (chainsaws), mechanical equipment, and hand tools to cut, clear, or prune herbaceous and woody target species.
- Cover type conversion, which uses herbicides in combination with manual/mechanical cutting to remove incompatible tall-growing trees and other vegetation from the right-of-way in order to establish a stable, low-growing plant community.

Removal of trees could occur under the following circumstances:

- Most trees growing directly below **distribution lines** (e.g., the “Wire Zone”) are typically pruned for clearance but may be removed depending upon line height, species, tree condition, and land owner directives.
- All trees located beneath the wire zone of **transmission lines** with 50ft or less of ground clearance are typically felled and the slash either chipped, or lopped and scattered along the edge of the ROW.
- Tree removal would be primarily limited to the ROW corridor and would target tall-growing species (e.g., for removal, in the border zones). All hazard trees tall enough to contact the conductors would be targeted for removal both inside and outside the ROW. An example of tree removal near transmission lines is provided in Figure 5 below.

Figure 5. Example of Border/Wire Zone Using Integrated Vegetation Management



6.2.2 Major Corrective Maintenance Activities

Major corrective maintenance activities, such as replacement or rebuild activities (see Figure 6), are planned efforts that are relatively large in scale (either through number of poles, duration, etc.) that occur on an infrequent basis, and may require ground disturbance within and outside of the existing ROW. Facilities may require replacement due to human- or natural-caused damages, age of facility, or other factors. This work generally is planned and encompasses more work than defined by routine maintenance activities. It may involve multiple structures, larger work crews, a variety of equipment, including heavy equipment, and usually take weeks or months to complete. Equipment that may be involved can include 4-wheel drive trucks, man lifts, material (flatbed) truck, bucket trucks, boom truck, tractor trailer, snow cat, excavator (back hoe or track hoe), grader, concrete truck, pumping equipment crane, etc. (see Appendix D for example photos of construction equipment).

Major corrective activities may include conductor replacement. Generally, many miles of conductor could be replaced during one project. This would require the use of staging, pulling, or lay-down areas for wire and equipment. Another example of a major corrective action would be substantial access road improvement and/or relocation, which may require modifications to existing permits/easements. This could involve grading outside of the authorized ROW and repair or installation of culverts and drains. New access to or along the power line ROW may be required and timing or seasonal restrictions should be considered for work within sage-grouse habitat (see BMP section). Projects that involve multiple-structure relocation or replacement would typically be considered major corrective actions. These activities could have similar footprints and durations as new construction activities.

Figure 6. Examples of Major Corrective Maintenance Activities

Activity	Description	Equipment	Frequency/ Duration
Multiple Structure Relocation or Replacement	Create staging pad and pole laydown area, dig new pole holes and anchor holes, frame structures, remove old poles	4wd truck, boom truck, excavator, bulldozer or other tracked vehicle, bucket truck, helicopter or crane, material truck	As needed/Days to weeks
Conductor Replacement	Replacing conductor typically associated with a non-emergency pole change-out	4wd truck, boom truck, bucket truck, material truck, crane or helicopter	As needed/Days to weeks
Access Road Improvement and Relocation	Altering the alignment of any existing access routes, creating replacement access, substantial grading and/or installing additional culverts	4wd truck, bulldozer, grader, excavator, material truck	As needed/Days to weeks

Most major activities involve grading, excavation or disturbing soils, and vegetation removal or crushing. These actions are expected to require site-specific environmental analysis and compliance with established permitting processes. Reclamation would be conducted to reseed and re-contour, if applicable, temporarily disturbed areas.

6.2.3 Emergency Maintenance Activities

An emergency situation is a condition or situation that is imminently likely to endanger life or property or that is imminently likely to cause a material adverse effect on security of, or damage to, a utility's electrical system and/or flow of electricity. Emergency maintenance activities are those activities necessary to promptly restore electrical service or repair damage caused by natural hazards, weather, fire, problem nests, or human actions to a line or structures. These activities include the need to repair a power line or prevent additional damage to a line that would eliminate a human health or safety hazard and prevent damage to property or resources in the event of an outage. The equipment necessary to carry out response to outages or emergency repairs is generally similar to that used to conduct routine maintenance. At times, emergency responses may require additional equipment to complete the repairs.

The implementation of routine operation and maintenance activities on power lines will minimize the need for most emergency repairs. In the event of an emergency, a utility must respond as quickly as possible to restore power and may be required to take actions beyond those authorized in its ROW grant/special use permit/easement agreement. This may include construction of new access routes or reworking access roads without prior agency review or approvals. Even though it is an emergency, utilities make concerted efforts to minimize environmental impacts. In most cases, notification to a land manager or resource agency of the emergency and actions taken will be done in concurrence with the utility responding to the emergency. Reasonable efforts should be taken during emergency response to reduce potential impacts to sage-grouse or their habitat. The utility and resource agencies should work together to identify and implement appropriate restoration or remedial measures after the emergency has been addressed.

6.2.4 Process for Determining if Maintenance Activity is "Green Lighted" or Requires Agency Coordination

Electric utility maintenance activities can be quite variable, from the potential level of impact to the operations employed, such as types of equipment used, to the site-specific conditions present. The following is a suggested process to guide whether a maintenance activity within identified sage-grouse habitat[14] can proceed with or without prior agency coordination or consultation, as appropriate.

Many of the routine maintenance activities described in Figure 4 are often conducted by an individual or, at most, a small crew with a limited number of vehicles and are completed within a short time-frame. Given the nature of these activities and implementation of BMPs (e.g., no work started prior to 9 a.m. during lekking), there would be very limited or no anticipated disturbance to sage-grouse. These types of maintenance activities would be considered "green lighted."

An example of such a "green lighted" project might be a broken insulator considered replacement on an existing power line. It is a required repair activity that would likely result in minimal disturbance and will occur over a short duration. It may even have multiple associated activities, as shown in Figure 8. Often such activity can be completed by one crew with one or two bucket trucks. Work can be conducted within the existing ROW, within the existing structure pad and using existing access roads. In some cases, this same activity may require the use of a back hoe or bulldozer to open up a road closed by boulders or other features used to restrict ROW access and use; minor road maintenance may also be required, such as minor re-grading of a washed out section or clearing of rocks or vegetation in the road. As long as the associated activities result in cumulatively limited to no impact, the project would still be "green lighted."

The process that would be used to determine if a proposed maintenance activity could be "green lighted" or may require additional agency coordination is described in Figure 7. Specific examples of "green lighted" maintenance activities are shown in Figure 8 and could be conducted within designated sage-grouse habitat or during seasonal or timing restrictions due to

[14] Identified sage-grouse habitat refers to BLM preliminary priority habitat (PPH), preliminary general habitat (PGH); state identified habitat (e.g., Wyoming core areas or Oregon core and low density areas); USFWS PAC; or other federal or state management category.

the limited or no anticipated disturbance effects. Utilities will still need to check with state sage-grouse plans, state/federal land management plans, and their ROW authorization for stipulations that may supersede this document. Examples of the type of maintenance activities that will likely require additional agency coordination to assess the level of disturbance, and thus would not be "green lighted," include multiple structure replacement, structure relocations, or major access road work as described in Figure 9.

Figure 7. Maintenance Activities Flowchart to Determine if Additional Agency Coordination Could Be Required

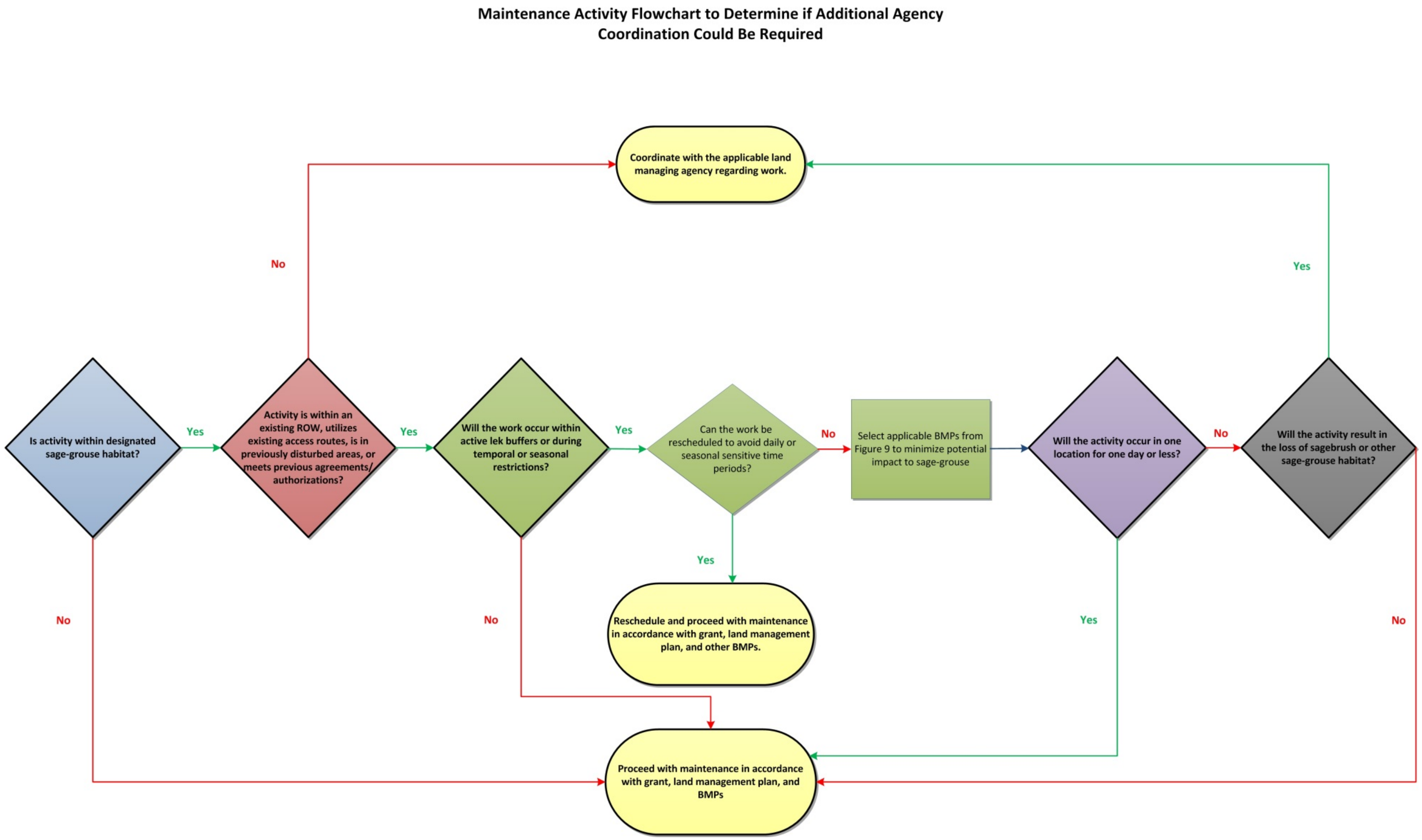


Figure 8. Examples of Maintenance Activities That Would be Green Lighted

Activity	Description	Equipment	Frequency/ Duration	Green Light
Inspections				
Aerial Inspection	Visual inspection of lines and poles to detect any safety or operational problems and nests on structures	Helicopter or fixed wing aircraft	Annual or semi-annual/Day(s) for a line, minutes per structure	Green Light
Ground Inspection/Pole Testing	Visual and physical inspection of lines and poles to detect any problems	ATV or 4wd truck	Semi-annual or annual/Day(s) for a line, minutes per each structure	Green Light
Maintenance				
Access Road Minor Maintenance or Improvements	Removal of access road obstructions, removing vegetation and minor re-grading of permitted and/or authorized ROW access roads only.	Grader/Small dozer, 4-wd pick-up truck, back hoe	Annually as needed Hours to a day in one location	Green Light
Guy Wire and Hardware Tightening/Insulator Repair	Tightening guy wires and other hardware Replacing broken insulators	Bucket truck or boom truck	As needed/Day(s)	Green Light
Problem Bird Nest Management	Addressing bird nests that pose a fire threat, hazard to the bird or potential power outage. Actions may include nest removal or relocation, nest platform installation, and/or pole modifications to discourage re-nesting[15]	Bucket truck or boom truck	When problem nests are identified/Hours or Day(s)	Green Light

[15] See APLIC (2006) for more details on management of nests on utility structures and associated permitting requirements

Activity	Description	Equipment	Frequency/ Duration	Green Light
Crossarm Replacement	Installing new crossarm on pole(s)	Bucket truck or boom truck	As needed/Hours	Green Light
Crossarm Reframing	Lowering crossarm to obtain avian-safe separations[16]	Bucket truck or boom truck	As needed/Hours	Green Light
Conductor Repair	Repairing conductor from vandalism (gunshots) or other defect	Bucket truck, pick-up truck, hot-line equipment	As needed/Hours	Green Light
Selected Vegetation Removal	Removing danger/hazard trees from ROW and those adjacent to the ROW posing a threat to the transmission or distribution lines	Chainsaw only	Hours	Green Light

[16] See APLIC (2006 and 2012) for additional information on preventing avian electrocutions and collisions with power lines.

Figure 9. Examples of Maintenance Activities That Will Likely Require Additional Agency Coordination

Activity	Description	Equipment	Frequency/ Duration
Multiple Structure Relocation or Replacement	Create staging pad and pole laydown area, dig new pole holes and anchor holes, frame structures, remove old poles	4wd truck, boom truck, excavator, bulldozer or other tracked vehicle, bucket truck, helicopter or crane, material truck	As needed/Days to weeks
Conductor Replacement	Replacing conductor typically associated with a non-emergency pole change-out	4wd truck, boom truck, bucket truck, material truck, crane or helicopter	As needed/Days to weeks
Access Road Major Improvements or Relocation	Altering the alignment of any existing access routes, creating replacement access, substantial grading and/or installing additional culverts	4wd truck, bulldozer, grader, excavator, material truck	As needed/Days to weeks
Vegetation Clearing	Large scale vegetation management activities meant to create sustainable ROWs-not imminent threat	Masticator, Chainsaws, Chipper, etc.	As needed (rarely)/Hours in one location but may occur over a period of weeks

7.0 UTILITY BEST MANAGEMENT PRACTICES IN SAGE-GROUSE AREAS

BMPs are specific means, measures, and practices that reduce or eliminate the detrimental effects of a proposed action. These measures, in some cases, are sufficient for meeting environmental policy and regulatory requirements. In some cases, additional formal and specific mitigation may be required to offset negative project impacts and ensure compliance with local, state, or federal regulations.

Resource agencies stipulate that utilities first avoid sage-grouse habitat, and minimize impacts if they cannot be entirely avoided, and lastly, mitigate for impacts that cannot be avoided or minimized. The Department of the Interior recommends a hierarchical approach to mitigation, in which, "the term 'mitigation' encompasses the full suite of activities to avoid, minimize, and compensate for adverse impacts to particular resources or values" both on and off site (Clement et al. 2014). Implementation of BMPs is an accepted method to minimize unavoidable impacts. APLIC and its agency partners have prepared this section to assist electric utilities in the identification and implementation of BMPs for avoiding and minimizing impacts to sage-grouse and their habitats during early stages of project planning through project construction and long-term maintenance activities for new and existing power line projects and their associated features in sage-grouse habitat.

Buffers surrounding sage-grouse leks are used in agency sage-grouse management plans to protect not only the leks, but a propensity of nesting hens within a given distance of the lek location (Coates et al. 2013). Consequently, buffers surrounding leks during the lekking season tend to be smaller than during the nesting season. The reason for this is because during the lekking season, the buffers are protecting birds on or near the lek from human activity and associated disturbance, whereas buffers used during the nesting season are protecting nesting sage-grouse, as research has shown that most sage-grouse may nest within three to four miles of lek sites (these distances vary by location).

Siting guidelines and stipulations for utility infrastructure in sage-grouse habitat vary between state and federal agencies, as well as within federal agencies. The effectiveness of these siting guidelines stipulations has not been adequately evaluated and there is some ambiguity in level of impacts or appropriate buffer distances related to electric utility activities. Siting guidelines and stipulations such as lek buffer distances, no surface occupancy and seasonal construction or maintenance timing restrictions have been developed by most states and federal land management agencies and are part of their respective sage-grouse conservation plans. The recommended siting guidelines and disturbance buffer stipulations for power lines in the various conservation plans differ between states and federal agencies. Because of these differences APLIC encourages the use of, and reference to, these BMPs and the specific state and federal sage-grouse plans where the project is located. In order to avoid a potential discrepancy with any of the existing or future sage-grouse plans, specific disturbance buffer distances are not provided in this BMP document. However, this document does contain BMPs calling for the use of buffers; users of this document should check their local agency plans and other authorization documents to determine recommended specific buffer distances and any seasonal timing stipulations/restrictions or other required stipulations for proposed activities within their project area.

The BMPs summarized below (Figure 10) are a ***list of voluntary conservation measures*** that can be included on a case-by-case basis into a utility's project siting, design and operational and maintenance programs for new and existing transmission and distribution lines to avoid and/or minimize impacts to sage-grouse and their habitats. A utility may choose to incorporate applicable BMPs into the utility's existing Avian Protection Plan (APP) or other internal environmental guidance documents, or (for new projects) into project-specific bird conservation plans. Applicable BMPs can also be incorporated into a request for the re-authorization or upgrading of existing facilities on state, federal, and tribal lands.

This ***list of BMPs is intended to provide measures and guidance*** that will assist to conserve sage-grouse and their habitat. The Conservation Objectives Team (COT) Report (USFWS 2013) details threats to sage-grouse and their habitat. The authors of this BMP document used the COT report as a framework to identify potential threats to sage-grouse associated with electric utility infrastructure and developed specific BMPs targeted toward minimizing those threats.

While not every BMP would be applicable for every project depending on case-by-case circumstances, the BMP list offers a suite of conservation practices that utilities and agencies can select from depending on the unique circumstances of their project. The BMP document can also be used as a reference for agencies to cite in their resource plans and permitting documents, particularly since the BMP document may be updated more frequently than RMPs/LUPs. Because this BMP document is intended to be updated as needed when new information is available, users are encouraged to check the APLIC website (ww.aplic.org) for the most current edition of the BMP document.

7.1 Best Management Practices for Electric Utility Activities in Sage-grouse Habitat[17]

7.1.1 Siting and Planning: Best Management Practices

S-1. Use existing sage-grouse use and habitat data to avoid siting and construction of new power lines and associated features in or over designated sage-grouse habitat, or near leks.

a. Obtain designated sage-grouse habitat (e.g., Priority Areas for Conservation (PACs), Preliminary Priority Habitat (PPH), Proposed Priority Management Areas (PPMA), "Connectivity," "Core" habitat and analogous) boundaries/delineations to aid in siting new power lines outside of designated habitat(s).

i. Consult federal land management plans (e.g., BLM RMP, USFS LUP) and state sage-grouse conservation plans, recovery plans and/or other strategies for existing boundaries/delineations of designated sage-grouse habitats and regulatory guidelines.[18]

b. Obtain lek location data from state and/or federal agencies to aid in siting of new power lines and designing construction activities.

i. Obtain current data from state and/or federal agencies that verifies the status of known sage-grouse leks. Leks will be assumed "active" if lek surveys are not conducted during that year to establish "inactivity." Consult with state wildlife agencies for their definitions of "active" and "inactive" leks. If no definitions are available, use definitions described in Connelly et al. (2000).

c. Consult state wildlife agency for known or available mapped seasonal habitat. Incorporate seasonal habitat (breeding/nesting, brood-rearing, winter) layers into project routing and planning.

i. Include designated Winter Concentration Areas (WCA) identified by state and/or federal agencies regardless of habitat designation.

ii. Include known/identified migratory corridors/routes identified by state and/or federal agencies regardless of habitat designation.

d. Develop and implement a project specific "checklist" as part of company's environmental protection measures. Use the project checklist to identify any siting constraints, sage-grouse habitat, and key areas (e.g., leks) within project areas early on so that these environmental considerations are included during siting and planning.

[17] The BMPs contained herein offer a list of voluntary conservation measures that can be included into a utility's project design and operational and maintenance programs for new and existing projects to avoid and/or minimize impacts to sage-grouse and their habitats.

[18] Note there may be differences in boundaries between regulatory agency plans.

S-2. Where impacts to designated sage-grouse habitat from siting a transmission line and associated roads/other features cannot be avoided, implement lek buffers around leks and nesting habitat during breeding/nesting season. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for buffer distances in designated habitat.

   a. If new facilities cannot completely avoid designated sage-grouse habitat(s), use micro siting to minimize impacts such as placement of new lines adjacent to existing linear infrastructure at an acceptable level of separation or in proximity to existing access roads and other sources of disturbance. Potential sage-grouse use of an area in which a transmission line is being sited should be considered, and micrositing employed to use topography to reduce visibility of towers or shield against potential collision risk.

S-3. When disturbance to "designated" sage-grouse habitat areas cannot be avoided, implement seasonal timing stipulations/restrictions for activities with the potential to impact sage-grouse. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for specific dates and time periods. Avoid active leks from 6:00 p.m. through 9:00 a.m. during the breeding ("lekking") season. In the absence of specific dates:

   a. Breeding (lekking)/Nesting season: 1 March – 15 May.

   b. Brood-rearing season: 1 May – 31 July.

   c. Winter Concentration Areas (WCA) or identified winter range: 16 November – 28 February.

S-4. Where unavoidable impacts to designated sage-grouse habitat are identified, evaluate engineering, economic, and environmental feasibility and costs/benefits of burying distribution lines in designated sage-grouse habitat (determined on a case-by-case basis). Where feasible, economically justified, and beneficial to sage-grouse, bury distribution lines crossing designated sage-grouse habitat (see Appendix A for factors associated with burying power lines).

S-5. Minimize disturbance/removal of vegetation in designated sage-grouse habitat by:

   a. Siting staging areas out of designated sage-grouse habitat and minimize size/footprint of staging areas.

   b. Siting pulling locations outside of designated sage-grouse habitat and minimizing size/footprint of pulling locations.

   c. Siting equipment storage outside of designated sage-grouse habitat.

   d. Minimizing development of new access roads by utilizing existing roads.

   e. Upgrading roads to the minimum extent necessary by using drive and crush access method when available.

f. Managing project access roads to limit public use in designated sage-grouse habitat.

S-6. Comply with required and voluntary density disturbance and surface disturbance caps in all sage-grouse habitat, regardless of designation or ownership (consult federal and state plans for existing disturbance caps).

a. Evaluate any existing power lines within project study area and associated features in designated sage-grouse habitats to determine if these features would impact either density cap.

b. If alternative routes to fully avoid PACs do not exist or are not feasible, do not exceed density or surface disturbance caps for new projects and associated features.

S-7. Build new power lines using recommendations identified by the Avian Power Line Interaction Committee to minimize electrocution and collision risks to all protected avian species (APLIC 2006, 2012, or most recent APLIC guidelines).

a. Design new lines to minimize risk of avian electrocution.

b. Site lines in areas outside of designated sage-grouse habitat and minimize crossing of riparian zones or water courses to reduce risk of any avian collision.

S-8. Partner or conduct research to obtain information on sage-grouse and power line-related avoidance, collision, or predation issues. Disseminate new research, BMP effectiveness data, lessons learned, etc. to cooperators/partners to aid in the ongoing improvement and refinement of BMPs. Such research may include:

a. Investigation of power line related impacts on sage-grouse (see UWIN 2011 for research protocols).

b. Effectiveness monitoring of implemented BMPs.

S-9. Develop programs to educate the public and utility customers on need for sage-grouse habitat conservation efforts, reasons to implement sage-grouse BMPs on new power line projects, and potential costs/timing restrictions.

S-10. Report conservation actions that benefit sage-grouse and ameliorate (identified in the COT Report) to the USFWS in the Conservation Efforts Database.

7.1.2 Construction: Best Management Practices

C-1. Avoid construction of new power lines and associated features in and over designated sage-grouse habitat by following siting and planning BMPs.

   a. Use environmental compliance monitors required as part of project stipulations during construction activities to ensure environmental project stipulations and BMPs are implemented and followed.

C-2. Where impacts to designated sage-grouse habitat from constructing a transmission lines and associated roads/other features cannot be avoided, implement lek buffers around leks and nesting habitat during breeding/nesting season. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for buffer distances (e.g., habitat protection categories and associated buffer distances).

C-3. When disturbance to "designated" sage-grouse habitat areas cannot be avoided, implement seasonal timing stipulations/restrictions for construction work. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for specific dates and time periods. Avoid active leks from 6:00 p.m. through 9:00 a.m. during the breeding ("lekking") season. In the absence of specific dates:

   a. Breeding (lekking)/Nesting season: 1 March – 15 May.

   b. Brood-rearing season: 1 May – 31 July.

   c. Winter Concentration Areas (WCA) or identified winter range: 16 November – 28 February.

C-4. Projects with the potential to disturb sage-grouse should be implemented in the least amount of time or during specified periods least likely to impact sage-grouse (while maintaining safe working practices).

C-5. Build and maintain power lines using recommendations identified by the Avian Power Line Interaction Committee to minimize electrocution and collision risks to all protected avian species (APLIC 2006, 2012, or most recent APLIC guidelines).

   a. Construct new lines to minimize risk of avian electrocution.

   b. Construct lines in areas outside of designated sage-grouse habitat and minimize crossing of riparian zones or water courses to reduce risk of avian collision.

C-6. Design and construct road crossings for ephemeral, intermittent, and perennial streams to minimize impacts to the riparian habitat, such as crossing at right angles to ephemeral drainages and stream crossings. Work with local regulatory agencies regarding state plans for sage-grouse, wetlands, etc.

C-7. Construct, upgrade, and maintain access roads to an appropriate standard but no larger than necessary to accommodate construction activities. Construct roads with considerations for minimizing vegetation removal (i.e., drive and crush), vehicle type (size, weight), and travel frequency, and with consideration of future access needs.

C-8. Conduct pre-construction weed surveys in areas before ground disturbing activities (e.g., high voltage transmission line construction) and implement conservation actions or pre-construction treatment to prevent and/or control noxious/invasive plant growth during and after reclamation and subsequent restoration efforts.

C-9. Vegetation and soil removal should be limited to the minimum disturbance required by the project. Topsoil that is removed should be stored in temporary use areas for re-use during reclamation if soil does not contain evidence of invasive grasses or noxious weeds.

C-10. Use approved herbicides, where applicable and authorized, to control invasive/noxious weeds and vegetation away from base of wood poles to reduce fire risk.

C-11. Avoid or minimize disturbance/removal of vegetation beneficial to sage-grouse (e.g., sagebrush, forbs, and native grasses) in designated sage-grouse habitat by:

a. Siting staging areas out of designated sage-grouse habitat and minimize size/footprint of staging areas.

b. Siting pulling locations outside of designated sage-grouse habitat.

c. Siting equipment storage outside of designated sage-grouse habitat.

d. Minimizing development of new access roads by utilizing existing roads.

e. Upgrading roads to the minimum extent necessary.

f. Managing project access roads to limit public use in designated sage-grouse habitats.

g. Use temporary mats laid down in sensitive sage-grouse use areas or habitats (e.g., wetlands, wet meadows, etc.) to prevent creation of tire ruts or vegetation damage.

C-12. Routinely inspect and wash vehicles and equipment to remove invasive or noxious weeds/plant materials, or seeds during construction activities.

a. Identify areas of known noxious weed infestations in construction areas to reduce the spread of invasive species to non-infested sites/areas regardless of habitat designation.

b. Avoid off-road travel in areas of known noxious weed infestations to reduce the spread of invasive species to non-infested sites/areas regardless of habitat designation.

C-13. Close/cover exposed tower foundation holes at the end of the work day to prevent sage-grouse or other wildlife from falling in and becoming trapped.

C-14. Limit the number of vehicles on site to those necessary to perform, monitor, and inspect work. Keep construction vehicles within designated construction areas and ROW.

C-15. Limit motorized travel to designated roads, trails, and construction areas. Comply with seasonal road/primitive road/trail restrictions.

a. Comply with seasonal closures outside of necessary utility access.

b. Where authorized and appropriate, gate and lock access roads to limit access to utility employees, agency personnel, and private land owners.

C-16. During construction establish speed limits on utility access roads crossing designated sage-grouse habitats. Include speed limit signage or awareness training as needed and enforce speed limits for company employees and contractors.

a. For a high voltage transmission line project where numerous vehicles are using an area over an extended period "Wildlife Crossing" signage may be used where applicable (e.g., near leks, brood-rearing habitat), to increase awareness of birds in the area and encourage safe and responsible speeds. This may reduce direct loss due to vehicle collision.

C-17. Contain, collect, and remove trash and construction debris regularly at construction sites and during maintenance activities to avoid attracting predators. Containers should have lids and trash removed as necessary to reduce overflow.

C-18. Properly manage, dispose, and remove slash piles as a result of construction or maintenance activities associated with vegetation management. Slash piles may increase fire fuel loads in the area as well as provide cover for predators.

C-19. Limit new noise levels at the perimeter of a lek to not exceed 10 dBA above a baseline ambient noise level (existing activity included) during the following periods:

a. From 6:00 p.m.to 9:00 a.m. during the breeding season (1 March – 15 May).

C-20. Establish and implement a fire prevention and suppression plan for construction activities Adhere to seasonal fire restrictions and stipulations which may include:

a. Educate crews how to enforce and practice appropriate fire prevention and suppression actions and behavior.

b. Minimize idling during construction and routine maintenance activities.

c. Park vehicles in designated parking or construction areas. Avoid parking over tall, dry vegetation.

d. Implement use of spark arrestors.

e. Conduct routine vehicle inspections:

i. Increase inspection frequency during high fire dangers for build-up of flammable vegetation (and other materials) and remove such materials.

ii. Confirm vehicles are equipped with designated fire suppression equipment.

f. Follow protocol for combustible materials storage, and develop appropriate fueling plan.

g. Clear flammable vegetation in work areas as appropriate before welding or related construction activities.

h. When welding in areas of high-risk fire danger, use a spotter.

i. Prohibit smoking or only smoke in designated areas.

j. Implement appropriate bird management practices (e.g., problem nest management, electrocution prevention) to reduce fire danger (see APLIC 2006).

k. As part of the fire suppression plan, identify fire suppression equipment needed in each vehicle and at each work site (e.g., number, size, and type of fire extinguishers, shovels, and Pulaskis) and identify fire suppression assistance contact information to keep in each vehicle and at each work site (e.g., telephone and radio contacts for federal and state land management agencies, local fire department, rural land fire protection associations, and county sheriff).

l. In certain circumstances, a transmission line corridor and associated access roads may be used by fire crews to access remote areas to assist with fire suppression efforts while minimizing creation of new roads or additional habitat impacts.

C-21. Reclaim ground/vegetation disturbances resulting from project-related construction activities and use local native seed mixes when they will meet restoration or re-vegetation efforts as approved by land owner/manager.

a. Landowners should be encouraged to use native plant seed mix for re-vegetation efforts on private lands. Effort should be made to control noxious and invasive weed species, including cheatgrass and Japanese brome that may occur after re-vegetation activities.

b. In certain instances, non-native vegetation (annual/sterile) may be used as a cover crop to prevent soil erosion and in fire prevention and suppression. A native understory may be ultimately established in the area. Ensure no invasive species are used. Consult with appropriate land management agency, especially when considering non-native adaptable species (e.g., forage kochia).

c. Reclamation efforts should attempt to re-establish native grasses, forbs, and shrubs to achieve cover, species composition, and life form diversity to benefit sage-grouse. Consult with local resource and land management agencies for appropriate seed mixes for individual project sites.

d. When reseeding temporary access roads, primitive roads, and trails, use seed mixes appropriate for vegetative conditions beneficial to sage-grouse and consider the use of transplanted sagebrush and/or sagebrush seedlings.

e. Restore reclaimed construction-related disturbances to vegetation representative of healthy sagebrush ecosystems and functional sage-grouse habitat.

C-22. In areas where corvid nesting and associated predation on sage-grouse nests and broods is a concern, use methods to discourage corvid nesting. This may include constructing nest minimizing designs (e.g., monopoles, single crossarms, etc.) for new lines, or retrofitting existing structures where there is an identified problem nest.

a. Migratory bird permits (e.g., utility SPUT permits) would typically authorize only the removal of inactive nests or active nests (excluding eagles and threatened/endangered species) that pose a safety, operational, or fire risk.

Nest removal activities should be limited to those nests that pose a problem/risk (risk to birds or potential power outage), and as authorized by state and/or federal permits.

b. Removal of nest material may be necessary multiple times during nest building to discourage corvids (ravens) from nesting on power poles. Nest material removal may also be most effective when done in conjunction with other methods to discourage corvid nesting. Utilities should contact the USFWS and their state wildlife agency to determine if removal of an active corvid nest would be authorized.

c. In areas where perching and/or nesting and associated predation is a concern, consult with the appropriate resource agencies to explore options to reduce impacts.

d. See APLIC (2006) and www.aplic.org for additional information on nest management.

C-23. Utilize existing sage-grouse use and habitat data to avoid impacts to sage-grouse and their associated designated sage-grouse habitats related to construction activities by identifying designated habitat where existing lines are located and scheduled maintenance activities will occur.

7.1.3 Operations and Maintenance: Best Management Practices

O&M-1. Use existing sage-grouse use and habitat data to avoid impacts to sage-grouse and their associated designated sage-grouse habitats related to operations and maintenance (O&M) activities by identifying designated habitat where existing lines are located and scheduled maintenance activities will occur.

O&M-2. Where designated sage-grouse habitat cannot be avoided, implement lek buffers around leks and nesting habitat during breeding/nesting season for non-emergency work. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for buffer distances in designated sage-grouse habitat.

O&M-3. Implement seasonal timing stipulations/restrictions for non-emergency O&M work. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for specific dates and times. In the absence of specific dates and times:

a. Avoid active leks from 6:00 p.m. through 9:00 a.m. during the breeding ("lekking") season.

b. Breeding (lekking)/Nesting season: 1 March – 15 May.

c. Brood-rearing season: 1 May – 31 July.

d. Winter Concentration Areas (WCA) or identified winter range: 16 November – 28 February.

O&M-4. O&M activities with the potential to disturb sage-grouse should be implemented in the least amount of time or during specified periods least likely to impact sage-grouse (while maintaining safe working practices).

O&M-5. Develop and implement a project specific checklist as part of a utility company's environmental protection measures. Use checklist to identify sage-grouse habitat and key areas (e.g., leks) potentially within project O&M work areas early on so that environmental considerations or constraints are included in project's O&M activities.

O&M-6. Establish and implement a fire prevention and suppression plan. Adhere to seasonal fire restrictions and stipulations which may include:

a. Educate crews how to enforce and practice appropriate fire prevention and suppression actions and behavior.

b. Minimize idling during construction and routine maintenance activities.

c. Park vehicles in designated parking or construction areas. Avoid parking over tall, dry vegetation.

d. Implement use of spark arrestors.

e. Conduct routine vehicle inspections:

   i. Increase inspection frequency during high fire dangers for build-up of flammable vegetation (and other materials) and remove.

   ii. Confirm vehicles are equipped with designated fire suppression equipment.

f. Follow protocol for combustible materials storage, and develop appropriate fueling plan.

g. Clear flammable vegetation in work areas as appropriate before welding or related construction activities.

h. When welding in areas of high-risk fire danger, use a spotter.

i. Prohibit smoking or only smoke in designated areas.

j. Implement appropriate bird management practices (e.g., problem nest management, electrocution prevention) to reduce fire danger (see APLIC 2006).

k. As part of the fire suppression plan, identify fire suppression equipment needed in each vehicle and at each work site (e.g., number, size, and type of fire extinguishers, shovels, and Pulaskis) and identify fire suppression assistance contact information to keep in each vehicle and at each work site (e.g., telephone and radio contacts for federal and state land management agencies, local fire department, rural land fire protection associations, and county sheriff).

l. In certain circumstances, a transmission line corridor and associated access roads may be used by fire crews to access remote areas to assist with fire suppression efforts while minimizing creation of new roads or additional habitat impacts.

O&M-7. Implement recommendations identified by the Avian Power Line Interaction Committee to minimize electrocution and collision risks (APLIC 2006, 2012, or most recent APLIC guidelines) and reduce fire danger.

O&M-8. Properly manage, dispose, and remove slash piles as a result of maintenance activities. Slash piles may increase fire fuel loads in the area as well as provide cover for predators.

O&M-9. Comply with project invasive/weed management plan or other company-wide vegetation management plans.

O&M-10. Reclaim ground/vegetation disturbances resulting from project-related O&M activities and use local native seed mixes for restoration or re-vegetation efforts as approved by land owner/manager.

a. Landowners should be encouraged to use native plant seed mix for re-vegetation efforts on private lands. Effort should be made to control noxious and invasive weed species, including cheatgrass and Japanese brome that may occur after re-vegetation activities.

b. In certain instances, non-native vegetation (annual/sterile) may be used to prevent soil erosion, where a native understory will be ultimately established. Ensure no invasive species are used (consult with appropriate land management agency).

c. Reclamation efforts should attempt to re-establish native grasses, forbs, and shrubs to achieve cover, species composition, and life form diversity to benefit sage-grouse. Consult with local resource and land management agencies for appropriate seed mixes for individual project sites.

d. When reseeding temporary access roads, primitive roads, and trails, use seed mixes appropriate for vegetative conditions beneficial to sage-grouse and consider the use of transplanted sagebrush.

e. Restore O&M related disturbances to vegetation representative of healthy sagebrush ecosystems and functional sage-grouse habitat.

O&M-11. In areas where off-road travel use is required and permitted, implement "drive and crush" methods for overland travel, when appropriate, instead of vegetation removal for maintenance access roads. This will reduce the impact on vegetation in comparison to cutting/mowing.

a. Use temporary mats laid down in sensitive areas (e.g., wetlands, wet meadows, sagebrush, etc.) to prevent creation of tire ruts or vegetation damage.

O&M-12. Routinely inspect and wash vehicles and equipment to remove invasive or noxious weeds/plant materials, or seeds during construction activities.

a. Avoid off-road travel in areas of known noxious weed infestations to reduce the spread of invasive species to non-infested sites/areas.

O&M-13. Establish speed limits on utility access roads crossing designated sage-grouse habitats.

O&M-14. Close exposed tower foundation holes at the end of the work day to prevent sage-grouse or other wildlife from falling in and becoming trapped.

O&M-15. Limit the number of vehicles on site to those necessary to perform, monitor, and inspect work. Keep vehicles within ROW.

O&M-16. Limit O&M motorized travel to designated work areas, roads and trails. Comply with seasonal road/primitive road/trail restrictions.

O&M-17. In areas where corvid nesting and associated predation on sage-grouse nests and broods is a concern, use methods to discourage corvid nesting. This may include use of nest minimizing designs (e.g., monopoles, single crossarms, etc.) for structure change-outs or retrofitting existing structures where there is an identified problem nest.

a. Migratory bird permits (e.g., utility SPUT permits) would typically authorize only the removal of inactive nests or active nests (excluding eagles and threatened/endangered species) that pose a safety, operational, or fire risk.

   Nest removal activities should be limited to those nests that pose a problem/risk (risk to birds or potential power outage), and as authorized by state and/or federal permits.

b. Removal of nest material may be necessary multiple times during nest building to discourage corvids (ravens) from nesting on power poles. Nest material removal may also be most effective when done in conjunction with other methods to discourage corvid nesting. Utilities should contact the USFWS and their state wildlife agency to determine if removal of an active corvid nest would be authorized.

c. In areas where perching and/or nesting and associated predation is a concern, consult with the appropriate resource agencies to explore options to reduce impacts.

d. See APLIC (2006) and www.aplic.org for additional information on nest management.

O&M-18. Remove pinyon pine or juniper trees that exist in the ROW. This may reduce trees growing into lines and associated risk of fire, and hinder conifer encroachment.

7.1.4 Removal, Reclamation, Restoration: Best Management Practices

R-1. Remove abandoned utility access roads, in accordance with land owners' permission, and reclaim to pre-disturbance or adjacent habitat conditions.

  a. Establish reclamation standards which should include restoring reclaimed areas to vegetation representative of healthy sagebrush ecosystems and functional sage-grouse habitat.

R-2. Remove abandoned utility infrastructure and reclaim to pre-disturbance or adjacent habitat conditions.

  a. Establish reclamation standards which should include restoring reclaimed areas to vegetation representative of healthy sagebrush ecosystems and functional sage-grouse habitat.

Figure 10. Summary of Best Management Practices and Associated Threats

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats						
			Energy Development	**Sagebrush Elimination**	**Noxious Weeds/Annual Grasses**	**Predation**	**Infrastructure**	**Fire**	**Conifer Encroachment**
Siting BMPs									
Siting	S-1	Avoid siting and construction of new power lines and associated features in "designated" habitat.	x	x			x		
Siting	S-2	Where "designated" sage-grouse habitat cannot be avoided, implement lek buffers around leks and nesting habitat during breeding/nesting season.	x	x					
Siting	S-3	When disturbance to "designated" sage-grouse habitat cannot be avoided, implement seasonal timing stipulations/restrictions for construction work.	x	x					
Siting	S-4	Evaluate engineering, economic, and environmental feasibility and costs/benefits of burying distribution lines in "designated" habitat (case-by-case basis).		x			x		
Siting	S-5	Minimize disturbance/removal of		x					

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
		vegetation in designated sage-grouse habitat.							
Siting	S-6	Comply with voluntary density disturbance and surface disturbance caps in all sage-grouse habitat (consult federal and state plans for existing disturbance caps).		x					
Siting	S-7	Build and maintain power lines using recommendations identified by APLIC to minimize electrocution and collision risks to all protected avian species.	x				x		
Siting	S-8	Partner or conduct research to obtain information on sage-grouse and power line-related avoidance, collision or predation issues. Disseminate new research, BMP effectiveness data, lessons learned, etc. to cooperators/partners to aid in the ongoing improvement of BMPs.	x				x		
Siting	S-9	Develop programs to educate the public and	x	x					

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
		utility customers on need for sage-grouse habitat conservation efforts, reasons to implement sage-grouse BMPs on new power line projects, and potential costs/timing restrictions.							
Siting	S-10	Report conservation actions that benefit to sage-grouse and ameliorate threats to the USFWS Conservation Efforts Database.	x						
Construction BMPs									
Construction	C-1	Avoid construction of new power lines and associated features in “designated” habitat and use construction monitors.	x	x			x		
Construction	C-2	Where “designated” sage-grouse habitat cannot be avoided, implement lek buffers around leks and nesting habitat during breeding/nesting season.	x	x					
Construction	C-3	When disturbance to “designated” sage-grouse	x	x					

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
		habitat cannot be avoided, implement seasonal timing stipulations/restrictions for construction work.							
Construction	C-4	Projects with the potential to disturb sage-grouse should be implemented in the least amount of time or during specified periods least likely to impact sage-grouse (while maintaining safe working practices).	x						
Construction	C-5	Build and maintain power lines using recommendations identified by APLIC to minimize electrocution and collision risks to all protected avian species and reduce fire risk.					x	x	
Construction	C-6	Design and construct road crossings for ephemeral, intermittent, and perennial streams to minimize impacts to riparian habitats.		x			x		
Construction	C-7	Design, upgrade, and maintain roads to an		x			x		

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats						
			Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
		appropriate standard no larger than necessary to accommodate their intended purposes. Use "drive and crush."							
Construction	C-8	Conduct pre-construction weed surveys in areas before high voltage transmission line construction and implement actions to prevent/control noxious/invasive plant growth after reclamation efforts.		x	x				
Construction	C-9	Vegetation removal should be limited to the minimum disturbance required by the project. Topsoil that is removed should be stored in temporary use areas for re-use.		x	x				
Construction	C-10	Use approved herbicides, where applicable and authorized, to control invasive/noxious weeds and reduce fire risks.		x	x			x	

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
Construction	C-11	Minimize disturbance/removal of beneficial vegetation in priority habitat.		x	x				
Construction	C-12	Inspect and wash vehicles and equipment to remove invasive or noxious weeds/plant materials or seeds.			x				
Construction	C-13	Close exposed tower foundation holes at the end of the work day to prevent sage-grouse or other wildlife from falling in and becoming trapped.	x						
Construction	C-14	Limit the number of vehicles on site to those necessary to perform, monitor, and inspect work. Keep construction vehicles within designated construction areas and ROW.	x	x					
Construction	C-15	Limit motorized travel to designated construction areas, roads and trails. Comply with seasonal road/primitive road/trail access and use restrictions.	x	x					

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats						
			Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
Construction	C-16	Establish speed limits on utility access roads crossing "designated" sage-grouse habitats.	x						
Construction	C-17	Contain, collect, and remove trash and construction debris regularly at construction sites and during maintenance activities to avoid attracting predators.				x			
Construction	C-18	Properly manage, dispose, and remove slash piles associated with construction or maintenance activities.				x		x	
Construction	C-19	Avoid activities that could result in new noise levels at the perimeter of a lek above 10 dBA above baseline ambient from 6:00 p.m.to 9:00 a.m. during the breeding season.	x						
Construction	C-20	Establish and implement a fire prevention and suppression plan and adhere to seasonal fire restrictions and stipulations.						x	

			Identified Threats						
Activity Type	**BMP No.**	**Abbreviated BMP Description**	**Energy Development**	**Sagebrush Elimination**	**Noxious Weeds/Annual Grasses**	**Predation**	**Infrastructure**	**Fire**	**Conifer Encroachment**
Construction	C-21	Reclaim ground/vegetation disturbances resulting from project-related construction activities and use local native seed mixes for restoration or re-vegetation efforts when they will meet restoration measures approved by landowner or land manager.	x	x	x		x		
Construction	C-22	In areas where corvid nesting and associated predation on sage-grouse nests and broods is a concern, consider methods to discourage nesting.				x	x		
Construction	C-23	Avoid impacts to sage-grouse and their associated priority habitats related to construction activities by using existing data.	x	x					
Operations and Maintenance BMPs									

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats						
			Energy Development	**Sagebrush Elimination**	**Noxious Weeds/Annual Grasses**	**Predation**	**Infrastructure**	**Fire**	**Conifer Encroachment**
O & M	O&M-1	Avoid impacts to sage-grouse and their associated priority habitats related to operations and maintenance (O&M) activities by using existing data.	x	x					
O & M	O&M-2	Where priority sage-grouse habitat cannot be avoided, implement lek buffers around leks and nesting habitat during breeding/nesting season.	x	x					
O & M	O&M-3	Identify and implement seasonal timing stipulations/restrictions for non-emergency O&M work.	x	x					
O & M	O&M-4	Projects with the potential to disturb sage-grouse should be implemented in the least amount of time or during specified periods least likely to impact sage-grouse (while maintaining safe work practices).	x	x					

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats						
			Energy Development	**Sagebrush Elimination**	**Noxious Weeds/Annual Grasses**	**Predation**	**Infrastructure**	**Fire**	**Conifer Encroachment**
O&M	O&M-5	Develop and implement a project specific checklist as part of utility company's environmental protection measures.							
O & M	O&M-6	Establish and implement a fire prevention and suppression plan and adhere to seasonal fire restrictions and stipulations.						x	
O & M	O&M-7	Build and maintain power lines using recommendations identified by APLIC to minimize electrocution and collision risks to all protected avian species and reduce fire danger.					x	x	
O & M	O&M-8	Properly manage, dispose, and remove slash piles as a result of vegetation maintenance activities.				x		x	
O & M	O&M-9	Comply with project invasive/weed management plan or other company-wide vegetation management plans.			x				x

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats						
			Energy Development	**Sagebrush Elimination**	**Noxious Weeds/Annual Grasses**	**Predation**	**Infrastructure**	**Fire**	**Conifer Encroachment**
O & M	O&M-10	Reclaim ground/vegetation disturbances from project related O&M and use local native seed mixes for restoration or re-vegetation efforts when they will meet restoration measures approved by land owner manager.		x	x				
O & M	O&M-11	Where off-road travel use is required and permitted, implement "drive and crush" methods for overland travel instead of vegetation removal for maintenance of access roads.		x			x		
O & M	O&M-12	Inspect and wash vehicles and equipment to remove invasive or noxious weeds/plant materials or seeds.			x				
O & M	O&M-13	Establish speed limits on utility access roads crossing "designated" sage-grouse habitats.	x						
O & M	O&M-14	Close exposed tower foundation holes at the end of the work day to prevent sage-grouse or	x						

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
		other wildlife from falling in and becoming trapped.							
O & M	O&M-15	Limit the number of vehicles on site to those necessary to perform, monitor, and inspect work. Keep maintenance vehicles within the ROW.	x						
O & M	O&M-16	Limit motorized travel to designated work areas, roads and trails. Comply with seasonal road/primitive road/trail restrictions.	x	x	x				
O & M	O&M-17	In areas where corvid nesting and associated predation on sage-grouse nests and broods is a concern, consider methods to discourage nesting.				x	x		
O & M	O&M-18	Remove pinyon pine and juniper trees in the ROW to minimize fire risks and hinder conifer encroachment.						x	x
Restoration									

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats						
			Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
Restoration	R-1	Remove abandoned utility access roads, in accordance with land owner's permission, and reclaim to pre-disturbance or adjacent habitat conditions.		x			x		
Restoration	R-2	Remove abandoned utility infrastructure and reclaim to pre-disturbance or adjacent habitat conditions.		x			x		

8.0 COMPENSATORY MITIGATION CONSIDERATIONS

Despite the use of BMPs to avoid and minimize impacts to sage-grouse and their habitat during new project construction and long term O&M activities, compensatory mitigation may be required to offset unavoidable impacts (direct and/or indirect). The following are examples of potential objectives that should be considered for mitigation planning. Utilities with projects requiring compensatory mitigation should work with state and federal agencies to identify compensatory mitigation projects, amounts, and locations appropriate to project-specific impacts.[19]

Since power lines and their associated features would likely be on the landscape for decades or longer and to meet agency mitigation objectives, compensatory mitigation for unavoidable impacts should consider the following:

1. Landscape Planning

   Compensatory mitigation projects should be developed in conjunction with, or guided by, a landscape-level conservation plan to maximize the benefit to sage-grouse and the sagebrush ecosystem upon which it depends over time.

2. Mitigation Hierarchy

   Activities should be designed, sited, and implemented so that they adhere to the basic hierarchy of avoidance, minimization, rehabilitation, and compensatory mitigation (also referred to as “offset”) as guided by a conservation/mitigation strategy.

3. Location

   Compensatory mitigation actions should be sited where landscape-level conservation strategies indicate the greatest conservation benefit to sage-grouse will be realized.

4. Additionally

   Actions proposed as compensatory mitigation must provide benefits beyond those that would be achieved anyway under applicable regulations and land-use management plans, and existing, planned, or ongoing programs.

[19] The BLM’s Regional Mitigation Manual provides guidance for mitigation of projects on BLM lands (see http://www.blm.gov/wo/st/en/info/mitigation.html). In addition, the USFWS published a range-wide mitigation framework for greater sage-grouse in 2014 (see http://www.fws.gov/greatersagegrouse/documents/Landowners/USFWS_GRSG%20RangeWide_Mitigation_Framework20140903.pdf).

5. Effectiveness

   Actions proposed as compensatory mitigation should be measurable and proven to be reasonably likely to meet identified objectives and deliver expected conservation benefits. The sage-grouse conservation benefits previously identified and agreed to could meet or be tied to multiple objectives (i.e., vegetation, fire suppression or soil erosion). Monitoring and adaptive management will be important components to ensure success, but should not be considered as compensatory mitigation. The ultimate measure of success will be use by sage-grouse and population performance within an identified project area.

6. Timeliness

   Compensatory mitigation actions should achieve targeted biological conditions in a timeframe commensurate with the life of the associated unavoidable impacts.

7. Durability

   Actions or plans proposed as compensatory mitigation should be accompanied by appropriate legal and financial assurances, and should require that ongoing and future management activities will not erode the conservation benefit of the mitigation, and mitigation should retain its conservation value over life of unavoidable project impacts.

8. Metrics

   Determining the anticipated impacts of new transmission lines and associated features, and the measures necessary to avoid, minimize, restore and/or offset those impacts should be based solely on the best available science using reliable and repeatable methods.

9. Species Benefit

   When unavoidable impacts and compensatory mitigation are factored, overall outcomes should result in a net conservation benefit to the species and/or the habitat that the species relies upon; a net benefit will provide greater confidence that projects are not negatively impacting sage-grouse populations.

Mitigation actions should be identified in conjunction with state and federal wildlife agencies and take into consideration any regional mitigation strategies that have been developed for sage-grouse or other species that utilize designated habitat.

9.0 STATE AND FEDERAL AGENCY SAGE-GROUSE PLANS

State and federal resource agencies have developed or are developing specific plans for sage-grouse management, or including sage-grouse conservation objectives in agency planning documents (e.g., FMPs, RMPs, etc.). Below is a list of agencies and their sage-grouse website links. Utilities and other users of this BMP document are encouraged to review state and federal agency planning documents that may contain stipulations, guidance, and site-specific information for sage-grouse in their area.

State Agency Plans

- California Department of Fish and Wildlife: https://www.wildlife.ca.gov/Regions/6/Greater-Sage-Grouse-Conservation
- Colorado Parks and Wildlife: http://cpw.state.co.us/learn/Pages/GreaterSagegrouseConservationPlan.aspx
- Idaho Department of Fish and Game: http://fishandgame.idaho.gov/public/wildlife/sagegrouse/
- Montana Fish, Wildlife, and Parks: http://fwp.mt.gov/fishAndWildlife/management/sageGrouse/
- Nevada Department of Wildlife: http://www.ndow.org/Nevada_Wildlife/Sage_Grouse/
- State of Nevada – Sagebrush Ecosystem Program: http://sagebrusheco.nv.gov/
- North Dakota Game and Fish Department: http://www.gf.nd.gov/conservation-nongame-wildlife/sage-grouse-management-plan
- Oregon Department of Fish and Wildlife: http://www.dfw.state.or.us/wildlife/sagegrouse/
- South Dakota Game, Fish, and Parks: http://gfp.sd.gov/hunting/small-game/sage-grouse-management.aspx
- Utah Division of Wildlife Resources: http://wildlife.utah.gov/uplandgame/sage-grouse/
- Washington Department of Fish and Wildlife: http://wdfw.wa.gov/publications/01317/
- Wyoming Game and Fish Department: http://wgfd.wyo.gov/web2011/wildlife-1000382.aspx

Federal Agency Plans/Documents

- Bureau of Land Management: http://www.blm.gov/wo/st/en/prog/more/sagegrouse.html
- Natural Resources Conservation Service: http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/null/?cid=steldevb1027671
- U.S. Fish and Wildlife Service: http://www.fws.gov/greatersagegrouse/
- U.S. Forest Service: http://www.fs.fed.us/research/wildlife-fish/themes/sage_grouse.php
- Environment Canada: http://www.ec.gc.ca/default.asp?lang=En&n=714D9AAE-1&news=8B997117-90A0-44DF-B62C-78E65A6419A4

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11.0 LIST OF ACRONYMS

ANSI	American National Standards Institute
APLIC	Avian Power Line Interaction Committee
APP	Avian Protection Plan
ATV	All-Terrain Vehicle
BACI	Before-After-Control-Impact
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BMP	Best Management Practice
CEQ	Council on Environmental Quality
COT	Conservation Objectives Team
EEI	Edison Electric Institute
EOC	Executive Oversight Committee (WAFWA)
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FLPMA	Federal Land Policy and Management Act
GIS	Geographic Information Systems
IVM	Integrated Vegetation Management
LUP	Land Use Plan
MBTA	Migratory Bird Treaty Act
MRO	Midwest Reliability Organization
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NGO	Non-governmental organization
NMFS	National Marine Fisheries Service
NRECA	National Rural Electric Cooperative Association
NSO	No Surface Occupancy
OSHA	Occupation Safety and Health Administration
PAC	Priority Areas for Conservation
PPH	Preliminary Priority Habitat
RISCT	Range-wide Interagency Sage-grouse Conservation Team
RMP	Resource Management Plan
ROW	Rights-of-way
RUS	Rural Utilities Service
SPUT	Special Purpose Utility (Permit)
UDWR	Utah Division of Wildlife Resources
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

UWIN	Utah Wildlife in Need
VMP	Vegetation Management Program
WAFWA	Western Association of Fish and Wildlife Agencies
WECC	Western Electricity Coordinating Council

12.0 GLOSSARY

Anode
An anode is an electrode that is receiving a current released from the cathode and delivering to a more easily corroded "sacrificial metal" that will then corrode instead of the protected metal.

Avian Protection Plan (APP)
An APP is a utility-specific program to reduce the operational and avian risks that result from avian interactions with electric utility facilities.

Avian-safe
A power pole configuration designed to minimize avian electrocution risk by providing sufficient separation between phases and between phases and grounds to accommodate the wrist-to-wrist or head-to-foot distance of a bird. If such separation cannot be provided, exposed parts are covered to reduce electrocution risk, or perch management is employed. This term has replaced the term “raptor-safe” used in the 1996 edition of APLIC’s *Suggested Practices*.

Before-After-Control-Impact (BACI)
Observational studies conducted to determine potential impacts of variables. Data is collected both before and after the response variable, and at both control and treatment (impact) study sites.

Boarder zone
An area on an electric utility right-of-way outside the wire zone, extending to the outer edge of the established right-of-way. Applies to electric utility rights-of-way only.

Cathode
The cathode is an electrode from which a conventional current leaves a polarized electrical device.

Cathodic protection (CP)
It is a technique used to control the corrosion of a metal surface by making it the cathode of an electrochemical cell. A simple method of protection that connects protected metal to a more easily corroded "sacrificial metal" to acting as the anode.

Circuit (single)
A conductor through which an electric current is intended to flow. The circuit is energized at a specified voltage.

Circuit (multiple)
A configuration or system of conductors that supports more than one circuit.

Co-location
Siting new infrastructure adjacent to or near existing infrastructure. For example, new power lines may be co-located with existing power lines, roads, or pipelines where feasible.

Conductor
The material (usually copper or aluminum)—usually in the form of a wire, cable or bus bar—suitable for carrying an electric current.

Configuration
The arrangement of parts or equipment on a utility structure. A distribution configuration would include the necessary arrangement of crossarms, braces, insulators, etc. to support one or more electrical circuits.

Construction staging area
Designated areas used temporarily to position vehicles, supplies, and equipment for access and use during power line construction.

Core area
Areas containing priority habitats for sage-grouse that represent high population abundance for the species' known breeding populations. This term is used specifically by certain states and not used as a range-wide designation.

Corridor
Strip of land designated in an agency land use plan as the preferred location for siting major linear ROWs and permits. Most corridors have identified lengths, widths and compatible uses (e.g., overhead only utilities, underground only utilities, or both).

Corvid
Birds belonging to the family Corvidae; includes crows, ravens, magpies, and jays.

Crossarm
A horizontal supporting member used to support electrical conductors and equipment for the purpose of distributing electrical energy. Can be made of wood, fiberglass, concrete, or steel, and manufactured in various lengths.

dBA
A-weighted decibels. A measure of environmental noise or sound.

Density disturbance cap
A maximum threshold of anthropogenic disturbance allowed within a given area. State sage-grouse management plans may include density disturbance caps or thresholds beyond which no new anthropogenic development is allowed.

Designated habitat
Sage-grouse habitat identified at the federal or state level as the highest priority habitat designation. This may include “core” habitat, “priority” habitat, “PACs,” and “delineated WCAs.” The term “designated” sage-grouse habitat, as used in this document, is not intended to include “general” habitat or “non-core” habitat

Distribution line
A circuit of low-voltage wires, energized at voltages from 2.4 kV to 35 kV, and used to distribute electricity to residential, industrial and commercial customers.

Drive and Crush
Driving overland within an identified overland access route. The landscape is not altered other than compaction of soil under the vehicle tires/tracks, and the vegetation may be crushed but not cleared or uprooted.

Easement
A type of special use authorization (usually granted for linear rights-of-way) that is used in those situations where a conveyance of a limited and transferable interest in National Forest System land is necessary or desirable to serve or facilitate authorized long-term uses, and that may be compensable according to its terms.

Energized
Any electrical conducting wire, equipment or device connected to any source of electricity.

Facility
As used in this manual, this term refers to all the equipment, wires, structures (e.g., poles and towers), etc., that are involved in carrying electricity.

Fault
A power disturbance that interrupts the quality of electrical supply. A fault can have a variety of causes including fires, ice storms, lightning, animal electrocutions, or equipment failures.

Gallinaceous
Birds of the order Galliformes, which include grouse, quail, partridges, pheasants, ptarmigan, and turkeys. Sage-grouse are galliforms.

Generation plant
A facility that generates electricity.

Ground
An object that makes an electrical connection with the earth.

Ground rod
Normally a copper-clad steel rod or galvanized steel rod, driven into the ground so that ground wires can be physically connected to the ground potential.

Guy
Secures the upright position of a pole and offsets physical loads imposed by conductors, wind, ice, etc. Guys are normally attached to anchors that are securely placed in the ground to withstand loads within various limits.

Insulator
Nonconductive material in a form designed to support a conductor physically and to separate it electrically from another conductor or object. Insulators are normally made of porcelain or polymer.

Kilovolt
1000 volts, abbreviated kV.

Latticework
The combination of steel members connected together to make complete structures, such as transmission towers or substation structures.

Lek
An area where two or more strutting male birds attend the same location for two years or more; not necessarily consecutive years. Several gallinaceous bird species, including sage-grouse, use leks.

> ***Active lek*****:** Based on a year-by-year review, a lek that has been attended by male sage-grouse during the annual strutting and breeding season.
>
> ***Occupied lek*****:** A sage-grouse lek which has been active at least once within the last 10 years.
>
> ***Inactive lek:*** A lek that has not been attended by 2 or more males for 2 or more of the previous 5 years. The lek should be surveyed several (3 or more) times in 5 consecutive years to establish that the lek has truly been abandoned or inactive. In absence of the aforementioned surveys, presence (activity and/or occupancy) should be assumed.

Lek buffer
An area, designated within a federal land use plan and/or state sage-grouse conservation plan, surrounding a lek that is protected against ground disturbing activities through seasonal and/or permanent no surface occupancy (NSO).

Lekking
The season in which male sage-grouse return to breeding grounds, known as leks, where they display for females attending the leks in hopes of breeding. Although this period varies across the range based on elevation and may vary slightly year-to-year relative to winter severity, sage-grouse typically attend leks from March through May.

Load
Electricity demand for a given area.

Micrositing
The process of considering site-specific landscape features into route planning. Micrositing may be used to avoid sage-grouse leks, important habitats, or other sensitive features.

Mitigation
The full suite of activities to avoid, minimize, and compensate for adverse impacts to particular resources or values.

Monopole
A structure composed of a single pole or tower used to support conductors or other equipment.

Nesting
The season when sage-grouse lay eggs and raise young.

Neutral conductor
A conductor or wire that is at ground potential, i.e., grounded.

Outage
Event that occurs when the energy source is cut off from the load.

Phase
An energized electrical conductor.

Phase-to-ground
The contact of an energized phase conductor to ground potential. A bird can cause a phase-to-ground fault when fleshy parts of its body touch an energized phase and ground simultaneously.

Phase-to-phase
The contact of two energized phase conductors. Birds can cause a phase-to-phase fault when the fleshy part of their wings or other body parts contact two energized phase conductors at the same time.

Pole
A vertical structure used to support electrical conductors and equipment for the purpose of distributing electrical energy. It can be made of wood, fiberglass, concrete, or steel, and manufactured in various heights.

Power line
A combination of conductors used to transmit or distribute electrical energy, normally supported by poles.

Preliminary General Habitat (PGH)
Areas of occupied seasonal or year-round habitat outside of PPH. These areas include Low Density Habitat, as well as additional areas of suitable sagebrush habitat. The BLM and USFS define PGH as habitat types of moderate importance, however, PGH may also include areas of higher quality habitat that lacks bird survey and inventory data to support a priority habitat ranking.

Preliminary Priority Habitat (PPH)
Essential, irreplaceable, and important sage-grouse habitats that include breeding habitat (lek sites and nesting habitat), brood-rearing habitat, winter range, and important movement corridors. The BLM and USFS define PPH as having the highest conservation value to maintaining sustainable sage-grouse populations.

Priority Areas for Conservation (PACs)
Term used in the USFWS 2013 COT Report to refer to the most important areas needed for maintaining sage-grouse representation, redundancy, and resilience across the landscape, as identified in state sage-grouse management plans. These areas were identified as highly important for long term viability of the species and a primary focus of conservation efforts.

Problem pole
A pole used by birds (usually for perching, nesting, or roosting) that has electrocuted birds or has a high electrocution risk.

Pulling location
Designated temporary construction use sites along a new power line corridor used to position conductor reels and pull conductors through insulators on overhead structures to proper tension.

Reliability
The percentage of time a line is delivering uninterrupted electricity.

Reroute
The act of removing an existing line or structure from the original right-of-way and rebuilding it along another route.

Retrofitting
The modification of an existing electrical power line structure to make it avian-safe.

Rights-of-way (ROW)
A nonexclusive, revocable authorization to use specific lands for a specific use (e.g., 230kV overhead transmission line and associated access roads). Most ROWs are authorized for a

specific term such as 30-50 years and include the right of renewal. The width of ROW required by each voltage level is generally dictated by state statutes and the National Electrical Safety Code (NESC) and is a function of span length, the conductor height above ground, and the conductor's low point of sag. Note: Short-term ROWs may also be authorized for extra temporary space required during construction, maintenance or modification of distribution or transmission lines.

Route
The pathway on which a right-of-way will be acquired and the new line constructed.

Sag
The distance measured vertically from a conductor to the straight line joining its two points of support.

Separation

On a structure: The physical distance between conductors and/or grounds from one another.

Between power line circuits: The physical distance between different power line circuits.

Siting
The process of identifying the points in the electrical system that need new lines of connection to deliver electricity to growing or new demand centers.

Span
The pole-to-pole or tower-to-tower distance of a power line.

Special Use Permit
A written permit, term permit, lease, or easement that authorizes use or occupancy of USFS lands and specifies the terms and conditions under which the use or occupancy may occur.

Structure
A pole or lattice assembly that supports electrical equipment for the transmission or distribution of electricity.

Substation
A transitional point (where voltage is increased or decreased) in the transmission and distribution system.

Termination
Structure or facility where power line ends, or where line transitions from underground to overhead.

Transmission line
Power lines designed and constructed to support voltages >69 kV. Voltages of 46kV to 69kV are considered sub-transmission lines and lines > 69kV but < 345kV are referred to as transmission lines. A high voltage power line is considered 345 kV or above.

Utility corridor
An area designated to site linear facilities (often a ROW is located within) between the line's origin and termination points, within which the potential line routes lie. The area in which a new line's routing alternatives are proposed and evaluated before the final route is determined and ROW authorization issued.

Volt
The measure of electrical potential.

Voltage
Electromotive force expressed in volts.

Voltage rating
The voltage rating of a transmission line depends on the utility's existing transmission system voltages, interconnections with other utilities, potential delivery points, and the amount of power that must be transmitted to meet load requirements. As voltages increase, the amount of power that can be transmitted increases. Various line-design parameters such as conductor size and configuration, spacing, and the number of conductors per phase (bundling) allow for increased transmission capability. Transmission voltages for carrying energy long distances are generally in the 115 to 765 kV range in North America.

Winter concentration area
Location(s) containing high quality sage-grouse winter habitat where large concentrations of sage-grouse have been observed repeatedly over time. Sometimes referred to as "winter refuge areas."

Wire Zone
An area on an electric utility ROW directly beneath and between the energized conductors farthest out on the pole/tower. This area is the most likely to contain vegetation that could potentially grow into contact with the energized conductors. This area is also typically used as access to the poles, towers, and conductors for repair, inspection, and maintenance. Applies to over-head electric utility ROWs only.

APPENDICES

Document continues on the following page.

Appendix A. Underground Power Lines and Perch Discouragers

Undergrounding power lines or installing perch discouragers are often raised as possible permit stipulations or mitigation options for new power lines or during the permit renewal of existing facilities in designated sage-grouse habitat. However, both of these practices have efficacy, cost, and unintended environmental concerns that must be considered. Often, such risks outweigh the intended benefits of these practices. However, when no other options are available and construction of a distribution power line in high quality sage-grouse habitat is proposed, undergrounding for discrete distances may be a viable alternative that can be evaluated. Undergrounding power lines and installing perch discouragers are not recommended as BMPs in certain circumstances and should only be used in limited applications where the associated risks/impacts are warranted. Below are details regarding the constraints associated with installing power lines underground and installing perch discouragers.

A.1 Underground Power Lines

Electric utilities install power lines either overhead or underground depending upon numerous considerations. Some key factors include customer needs, costs, code requirements, terrain, voltage, and technological and environmental restrictions. Cost is a major concern as regulated electric utilities are dictated by public service commissions to serve customers with safe, reliable, and efficient electric service at the lowest cost possible. Undergrounding can contribute to higher construction costs, longer outages and more expensive repair service that will affect customers. Terrain, habitat type, existing infrastructure or natural features, maintenance access, reliability and construction constraints or other factors are considerations that need to be evaluated prior to proposing to construct an underground line.

Power lines, particularly residential distribution lines (e.g., 35 kV and below), may be installed underground in newly developed areas, where it has been found feasible to do so. However, at transmission voltages (e.g., at 46 kV and above), installing lines underground is often not physically or financially feasible. Environmental concerns may preclude underground installation of power lines of both transmission and distribution voltages. In certain circumstances, however, undergrounding distribution power lines may be a viable alternative, where high value sage-grouse habitat will be impacted and mitigation costs to offset those impacts may have significant influence on the cost-benefit analysis. Because of the above considerations, the discussion of underground power lines as a BMP in this document refers to distribution, not transmission, voltages.

This section discusses engineering, environmental and financial considerations of undergrounding power lines.

A.1.a Engineering Considerations

Undergrounding construction process: For power lines >46 kV, open trench installation or the more costly trenchless technologies are used to place the cables underground. Construction includes, but may not be limited to, clearing of the ROW, trenching, installation of duct banks or pipe networks, installation of vaults, cable splicing and terminating, and termination structure construction.

Trenching: Generally the most common technique for placing underground lines requires open cut trenching and a large surface excavation to install the required infrastructure. The typical trench dimensions vary by cable type, voltage level, and required power transfer, but in all cases require a minimum cover depth of 3 feet (Figure 11 shows examples of trenching and underground power line construction). While a number of cable arrangements can be achieved, soil characteristics and existing infrastructure often play the largest role of how the installations are designed. In urban areas, trenching operations are typically staged such that a maximum of 300 to 500 feet of trench is open at any one time. Steel plating may be positioned over the open trench to minimize surface disruptions, while traffic controls can alleviate congestion through the project area. Emergency vehicle and local access must be coordinated with local jurisdictions as necessary.

Installation: Single- and double-circuit solid dielectric cable systems are often installed in duct bank configurations. Another method is direct burial.

Vault Installation: In a vault installation, preformed concrete splice vaults are placed at approximately 1,500- to 2,000-foot intervals depending on the maximum cable per reel length. The vaults, initially used to install the cables into the conduits, are primarily used to house the splice assemblies, and to provide access for inspections of the system. The vaults are used to sectionalize segments of cable in the event of a failure in order to locate the faulted cable and repair the required section. The typical installation time frame of each vault is approximately two weeks beginning with excavation, placement, compaction, and finally resurfacing of the excavated area.

Cable Pulling, Splicing, and Termination: Upon completion of the civil construction, cables are installed within the duct banks or steel pipes. Each cable segment is installed, spliced at each of the vaults along the route, and terminated at the transition sites where the cable connects to overhead conductors. To install the cable, a reel of cable is positioned at one end of a cable section, while a pulling rig is located at the other end. Using wire rope, each section of cable is installed into its respective conduit/steel pipe, while workers apply either water-based lubricant for solid dielectric cable or dielectric fluid for pipe type cable, to the cable jacket to minimize the frictional forces placed on the cables. Before termination or splicing operations begin, the cables are trained into the correct position using heat blankets. This process removes the curvature of the cable from being on the reel while also relieving any longitudinal strain exerted on the cable during pulling operations.

Termination Structure Construction: Overhead termination structures are required for underground lines. For distribution voltages, termination structures can pose avian electrocution risks or provide nest substrates for raptors or ravens. Utilities should review the APLIC guidance for avian-safe riser pole designs (see http://www.aplic.org/riser-poles-wind.php).

Underground lines may require additional equipment to compensate for voltage changes along the length of the line. This limits the length of line that can be installed underground, particularly as voltages increase. In addition, additional equipment needed to regulate voltage increases overall costs and likelihood of failures due to additional components.

Human Activity During Construction and Maintenance/Repairs: Construction of underground power lines can take three to six times longer than overhead line construction (Tri-State Generation and Transmission Association 2011). Maintenance and repairs of underground power lines also take longer than overhead lines, as crews must excavate cables to identify problems and make repairs.

Operations, Maintenance, and Reliability: Underground power lines can be difficult to repair when the ground is frozen and access to underground facilities can be hampered by heavy snow, delaying outage response times. Underground power lines are susceptible to flooding and are still vulnerable to lightning damage to equipment. Underground power lines are vulnerable to dig-ins by those that may not follow proper procedures to identify underground facilities prior to excavation. Stray voltage concerns are increased with underground, versus, overhead lines. A catastrophic failure of any portion of an underground system (cable, splices, terminations, or fluid systems) could result in the cable system being inoperable and out of service. Underground lines are subject to joint failure, which can be difficult to locate and repair (Patrick Engineering 2010). While underground systems comparatively have fewer forced outages than overhead lines, damage to the cable or components often results in longer outage durations. When a failure does occur, overhead lines can be visually inspected quickly and repaired. In contrast, underground line cable failures cannot be visually diagnosed. The cable system must be tested with specialized equipment to locate the damaged sections of the cable. Upon locating the faulty component or cable, specially trained workers must be mobilized to repair or replace the failed components or cable resulting in potential outages of days, weeks or months, depending on the type of failure to be repaired, the failure location, and the availability of replacement materials (damage to overhead lines can typically be repaired within several hours or days). The possibility of such extended outages remove undergrounding as a viable option for customers requiring high reliability (e.g., hospitals, manufacturing plants) or in areas where there is no redundancy to serve affected customers.

Basic maintenance of underground power line systems consists of thorough and frequent inspections. For transmission voltages, this could include a yearly inspection of the cable system and a monthly test and inspection of the fluid systems. Inspections would include all terminations and splices, all bonding systems, valves, gauges, switches, and alarms within the pumping plant. Cathodic protection systems would be monitored as an ongoing process.

Longevity: Long-term reliability of underground power line cables is a major concern for electric utilities. Underground power lines have a substantially shorter life span than overhead power lines. The Edison Electric Institute (2012) estimates that much of the underground cable installed in the 1970s and 1980s now needs replacement. The effective longevity of an underground power line is about half that of an overhead power line.

A.1.b Environmental Considerations

Ground Disturbance: While access road requirements are similar for both underground and overhead lines, underground transmission lines require a continuous excavation through all habitat types. This is in contrast to overhead lines, which result in a physical habitat modification only at the structure locations. The ground modification is greater for underground lines than overhead lines of the same voltage. The need for trenching and additional ground disturbance of native vegetation may lead to the introduction of invasive plants and noxious weeds, soil compaction and other factors that impact the native vegetation/habitats along the ROW. However, these relatively greater ground modifications may be addressed similar to how other linear energy projects (i.e., pipelines) are addressed, via restoration, monitoring, and weed management programs. Prior to constructing a distribution power line underground, utilities should consult with state and federal managers in areas where invasive/noxious weed expansion is a risk due to increased ground disturbance, both during construction and maintenance, associated with underground power lines.

Construction of both underground and overhead power lines would require ground disturbance at staging and other construction areas, and for associated access roads. However, the amount of ground disturbance associated with the line itself would differ. For underground lines, excavation for trenching and laying conductor would result in ground modification for the entire line route. For overhead lines, ground modifications would occur at structure locations. The extensive vegetation clearing required for underground power lines may cause fugitive dust or soil erosion problems during construction and reclamation, particularly in arid environments where re-establishing vegetation, particularly for sagebrush, may be difficult. BMPs can be applied to minimize fugitive dust and soil erosion. Large shrubs and trees would be controlled within the ROW to prevent potential problems with roots that could interfere with the underground system. Underground lines would also require excavation for repairs or maintenance, which would result in areas of ground disturbance occurring temporally over the life of the line, not just during initial construction. Ground disturbance during construction, repairs, and maintenance can result in large, permanent displacement of excavated soil and subsequent issues with re-establishing native vegetation. A University of California study (Bumby et al. 2009) found that underground power lines have more environmental impacts than overhead power lines for all categories and most scenarios in southern California; this study assessed environmental variables associated with the materials, construction, and operations of a power line. Likewise, environmental impacts of underground lines are greater than overhead lines due to ground disturbance, project footprint, vegetation removal, noise and dust associated with construction, construction duration, and subsequent ground disturbance and vegetation removal associated with maintenance and repairs (Tri-State Generation and Transmission Association 2011, Xcel Energy 2011, APLIC 2012). In addition to environmental concerns, underground lines can have a greater impact on archaeological and paleontological resources than overhead lines due to the amount of trenching and ground disturbance.

Additionally, environmental damage can result if a buried power line is near or crosses a waterway or is in sagebrush steppe or other sensitive habitats. If an oil-filled conductor pipe leaks, the oil could contaminate the water and surrounding soil, and damage vegetation.

A.1.c Financial Considerations

One major reason that utilities do not normally install high voltage transmission lines underground is that the construction costs are increased by 4 to 17 times over the aboveground alternative (National Grid 2009, Patrick Engineering 2010, Public Service Commission of Wisconsin 2011, Tri-State Generation and Transmission Association 2011). More recent studies have shown that some costs may be reduced but are still 10 to 12 times the cost of equivalent overhead installation (Patrick Engineering 2010). The Edison Electric Institute (2012) calculated cost ranges for transmission and distribution lines installed overhead or underground in different environments. In rural areas, they found that installation of overhead transmission lines cost between $174K and $6.5 million per mile, while underground transmission lines cost between $1.4 million and $27 million per mile. Similarly, costs per mile for distribution lines in rural areas ranged from $86.7K to $903K for overhead and $297.2K to $1.84 million for underground. In addition to construction costs, utilities must consider associated environmental costs, such as line planning/routing to avoid environmentally sensitive areas, biological surveys, environmental monitors, reclamation, mitigation, and other environmental-related costs. In some circumstances, the increased mitigation costs for sage-grouse impacts of an overhead line may make other underground cost considerations more equitable. Depending on state and federal agency plans and project-specific mitigation requirements, mitigation costs may differ for overhead or underground lines. Some agency plans may consider line undergrounding as a form of mitigation, which could influence the overall project cost.

For investor owned utilities, the additional costs of undergrounding must be approved by the public utilities commissions and are passed on to all the ratepayers, not just those near the area of underground installation. Similar to investor owned utilities, electrical co-op members not in sage-grouse habitat would bear the costs for those member utilities within sage-grouse habitats.

In addition to the initial construction costs, long-term operations and maintenance costs are higher for power lines installed underground. Also, underground lines in geographic areas with severe frost, heavy snow, and/or rocky terrain can have further increased maintenance and repair costs.

Examples of Underground Power Line Construction

A.2 Perch Discouragers

Nesting and perching of raptors and corvids on utility power lines and other tall infrastructure in sagebrush steppe habitats occupied by sage-grouse are perceived as a threat to sage-grouse due to the potential for increased predation on both adults and young. Common raven (*Corvus corax*) nesting in southeastern Idaho was correlated with transmission lines and edges between sagebrush habitat and landscapes associated with human disturbance or fire (Howe et al. 2014). In northwestern Nevada, common ravens accounted for 46.7% of sage-grouse nest predation (Lockyer et al. 2013). While predation effects of ravens have recently been assessed, raptor predation of sage-grouse associated with tall structures is not well understood nor have there been many scientific studies conducted that have documented this threat in the scientific literature (Messmer et al. 2013).

Perch discouragers are a mitigation measure often recommended or required by federal land managers to prevent perching or nesting of corvids and raptors on distribution poles and transmission line structures in areas with sage-grouse or other sensitive species. Perch discouragers were originally designed to reduce raptor electrocutions, and were widely used by the electric utility industry from the 1970s to 1990s. Perch discouragers were intended to move birds from an unsafe (electrocution risk) perching location to a safer alternative, either on the same structure or nearby on the same line (APLIC 1996). For many years, perch discouragers were the only available option for retrofitting poles to reduce electrocutions. However, recent data has documented poor effectiveness in perch discouragers and greater effectiveness of bird protection covers for preventing electrocutions (see APLIC 2006 and www.aplic.org for more information on covers and other techniques to prevent avian electrocutions). This has resulted in a shift towards covers instead of perch discouragers for electrocution prevention.

Despite their declining use by electric utilities, perch discouragers have been installed in attempts to dissuade raptors and corvids from perching or nesting on power poles in areas with sage-grouse or other sensitive prey species. Currently, perch discouragers are often required in new ROW grant authorizations for new power line construction or in some cases for re-authorizations of existing lines in sage-grouse designated habitats. There have been several studies assessing the effectiveness of discouragers in minimizing perching. This research has shown limited effectiveness in preventing perching (Lammers and Collopy 2007, Prather and Messmer 2010) with some species using alternate perch sites such as crossbraces and the shield wire to perch on when discouragers are present (Slater and Smith 2010) as shown in Figure 12. Below is a summary of perch discourager research.

- Lammers and Collopy (2007) conducted a study to evaluate the effectiveness of perch discouragers on the Falcon-Gondor transmission line in Nevada. This study found that although the duration of perching events was minimized on structures with discouragers, birds were still able to overcome the discouragers. Consequently, the authors felt that the discouragers did not achieve the desired results.

- Slater and Smith (2008) evaluated the effectiveness of existing perch discouragers on an H-frame transmission line in southwestern Wyoming. The line with perch discouragers was adjacent to an existing line of similar construction without perch discouragers. The results of this study showed that birds used the structures without perch discouragers more than structures with discouragers, but perching was not entirely prevented. Given the close proximity of the two lines, the birds selected an "open" perch site as opposed to one with a barrier. The study documented the construction of a raven nest between deterrent devices. Two sage-grouse mortalities were documented during the study, which were suspected to have resulted from avian predation and a line collision.
- Prather and Messmer (2010) assessed the effectiveness of five different perch discourager types on a distribution line in southern Utah in an area with Gunnison sage-grouse. The study found that none of the discouragers were more effective than the control structures in preventing perching. The study also collected data on prey remains and evidence of sage-grouse mortality found below poles. No evidence of predation on sage-grouse was documented, nor were any sage-grouse documented in any prey remains. The majority of prey remains contained lagomorphs. It should also be noted that the utility documented eagle electrocutions on this line associated with the discouragers after the study was completed (PacifiCorp, unpublished data).
- Rocky Mountain Power is conducting an ongoing study to monitor the effectiveness of perch discouragers and document avian use associated with a transmission line with spike discouragers in sage-grouse habitat in southwestern Wyoming (Liguori 2012). The study documented increased perching on H-frame transmission structures with discouragers compared to monopole designs, as well as perching on transmission line static conductors. A high rate of perch discourager mechanical failure was documented during the survey.
- PacifiCorp conducted avian risk assessment surveys of over 120,000 distribution poles from 2001 to 2012 in Utah, Wyoming, Idaho, Oregon, Washington, and California (Liguori 2013). During these surveys, raptor/raven perching was observed two times more frequently on poles with perch discouragers compared to poles without discouragers. Likewise, evidence of raptor use at poles (e.g., pellets, prey remains, whitewash) was 1.3 times greater at poles with perch discouragers compared to poles without discouragers. Perch discourager poles were also associated with increased electrocution mortality rates (3.6 times greater) and increased raptor/raven nesting on poles (4 times greater). Poles nearby poles with perch discouragers also had higher electrocution mortality rates than control sites. Because of these unintended consequences, the company removed perch discouragers from its avian protection material standards.

These various studies have documented that the availability of other perch sites influences the effectiveness of perch discouragers. In areas where there were other available perch sites nearby, perch discouragers appeared to be more effective and "pushed" birds from one perch location to another. In areas where other perch substrates were limited, the birds overcame the perch discouragers and were able to perch on the structures despite the discouragers.

Because perch discouragers may push birds to nearby poles that may not be avian-safe and pose an electrocution risk, their use has been discouraged (APLIC 2006). Likewise, in areas where raven predation on sage-grouse nests is a concern, perch discouragers may aid in the accumulation of nest material (APLIC 2006), and could potentially increase raven predation pressure due to nest construction on discouragers in sensitive areas. An investigation of landscape-level patterns in common raven behavior and distribution in Wyoming suggested that the majority of sage-grouse nest predation by common ravens is carried out by resident territorial individuals (i.e., nesting birds), rather than non-breeding individuals (Bui et al. 2010). The negative impacts of perch discouragers must be weighed against the limited benefits they may provide, particularly if they are contributing to mortalities of birds protected under ESA, MBTA, BGEPA, and State laws, and facilitating increases in predator nesting populations.

The avian predators of sage-grouse should also be considered, as different species exhibit different hunting strategies, and employ different hunting techniques for different prey species. For example, golden eagle (*Aquila chrysaetos*) diet is largely mammalian (80-90%, Kochert et al. 2002). Golden eagles prey on sage-grouse opportunistically, and typically hunt sage-grouse by stooping from a high soar (Watson 1997, Kochert et al. 2002). Consequently, power poles may not play an important role in eagle predation of sage-grouse. Golden eagles, however, are vulnerable to electrocution mortality (APLIC 2006) and perch discouragers have been correlated with increased eagle electrocution risk (PacifiCorp, *in prep*.). Common ravens are known predators of sage-grouse nests, yet ravens are able to overcome perch discouragers and may experience higher nesting rates on poles with perch discouragers.

These sage-grouse BMPs are intended to be compatible with conservation measures for other protected species (e.g., electrocution prevention measures for raptors and other migratory birds). Consequently, prior to the use of perch discouragers, utilities and resource agencies should assess their potential risks/benefits to sage-grouse as well as other protected avian species.

Examples of Perch Discouragers, Including Perching and Nesting

Red-tailed hawk (and mountain bluebird) perched on H-frame pole with perch discouragers

Red-tailed hawk (left) flushing common raven (right) from transmission pole with perch discouragers.

Common raven nest on transmission pole with spike discouragers.

Common raven nest on transmission pole with steel "Y" discouragers.

Golden eagles perched on adjacent distribution poles with moving/hazing and barrier-type discouragers

Golden eagle perched on distribution pole with cone discouragers, and common raven perched on conductor

Appendix B. WAFWA White Paper on Sage-grouse/Power Line Research

Document continues on the following page.

Evaluation of Impacts from Electric Transmission and Distribution Lines in Greater Sage-Grouse Habitat – White Paper – Revised 2014

Utah Wildlife in Need (UWIN), a Utah-based 501(c)(3), non-profit organization, and its partners (the Utah Division of Wildlife Resources, Rocky Mountain Power, Idaho Power Company, Northwestern Power, and Avian Power Line Interaction Committee (APLIC) initiated an aggressive project to collect information and develop research protocols to assess the impacts of siting and operating electric transmission lines (tall structures) in sage-grouse habitat. The science-based information generated by this project will facilitate the development of consistent and effective best management practices (BMP) to help ensure long-term conservation of sage-grouse.

Problem Statement

In 2010, the U.S. Fish and Wildlife Service (FWS) placed the greater sage-grouse (sage-grouse) on the list of species that are candidates for protection under the Endangered Species Act (ESA). One reason cited in the decision is the lack of adequate regulatory mechanisms to protect sage-grouse. Infrastructure development, including power lines, is believed to cause avoidance behavior, increased raptor predation and habitat fragmentation and research was needed to determine if these were contributing factors.

Increasing demands for energy and for the development of renewable and alternative energy sources require new power lines be built to transmit this power from where it is generated, which is often in remote areas, to more populated load centers. Wildlife scientists and public land managers are concerned these new, tall high voltage transmission and distribution structures will further impact sage-grouse.

Proposed Solution

In 2005, the Western Association of Fish and Wildlife Agencies (WAFWA) convened a diverse group of stakeholders to identify problems and strategies to conserve sage-grouse. This forum developed the *Greater Sage-grouse Comprehensive Conservation Strategy*[1] (2006), and in that document, recognized the need to assess the potential effect tall structure may have on sage-grouse. Thus, the following four goals were identified in Appendix C, pages 29-31 of the *Strategy* document:

1. Compile and evaluate published research on the effects on sage-grouse due to impacts of existing tall structures.

2. Develop research protocols to conduct new studies to assess impacts of tall structures.

3. Develop scientific and consistent siting and operation and maintenance (O&M) criteria for tall structures in sage-grouse habitat to minimize negative impacts on sage-grouse.

4. Develop BMPs and appropriate mitigation measures to implement for siting and O&M activities associated with tall structures.

1 *Greater Sage-grouse Comprehensive Strategy Stiver et al. 2006. http://www.wafwa.org/documents/pdf/GreaterSage-grouseConservationStrategy2006.pdf*

Goal Attainment

Under the direction and support of WAFWA and the Sage-grouse Executive Oversight Committee[2] (EOC), UWIN and its partners initiated an inclusive, consensus based process to address and attain the four goals identified in the WAFWA *Strategy* document.

Goal 1 was addressed in September 2010 with UWIN's publication of *Contemporary Knowledge and Research Needs Regarding the Effects of Tall Structures on Sage-grouse* (www.utahcbcp.org). The authors concluded that no peer-reviewed, experimental studies either confirmed or denied the effects of tall structures on sage-grouse. The report concluded that additional research is required to effectively evaluate/ascertain the effects.

Goal 2 was attained in July 2011, with UWIN's publication of *Protocol for Investigating the Effects of Tall Structures on Sage-grouse (Centrocercus spp.) within Designated Energy Corridors* (www.utahcbcp.org). Acknowledged sage-grouse research experts, wildlife biologists, public and private land managers, and energy representatives developed the study-design protocol (Protocol). The Protocol recommends rigorous, replicated research based on a "Before-After-Control-Impact" (BACI) study paired treatment approach. Several representatives that developed this protocol also participated in the published NWCC[3] research protocols supported by the USFWS, but which did not address transmission lines. Such research is necessary to adequately address **Goal 3** (siting and O&M) criteria) and **Goal 4** (BMPs). The Protocol is designed to address three specific research questions:

- Do sage-grouse avoid tall structures and if so, why?
- Do tall structures increase avian predation by providing increased nesting and perching opportunities? If there is an increase in avian predation, is it significant on a population level?
- Do tall structures create fragmentation of habitat that limits use or movement of sage-grouse?

On September 13, 2011 the EOC adopted the *Protocol for Investigating the Effects of Tall Structures on Sage-grouse within Designated and Proposed Energy Corridors* as a minimum protocol for researching the impacts of electric transmission and distribution lines on sage-grouse populations and habitat. Given the current inconclusive nature of the indirect impacts of tall structures on sage grouse, the EOC approved referring to potential indirect impacts as "unknown" impacts. The use of "unknown" impacts is also supported by the results of UWIN's literature review publication referenced in Goal 1. Further, the EOC adopted a series of recommendations from the Range-wide Sage-grouse Interagency Conservation team (RISCT) regarding participation in the studies, determining study sites and funding research opportunities using a portion of a project's "unknown impacts" mitigation budget.

Research that follows the Protocol is necessary to adequately address **Goal 3** (siting and O&M criteria) and **Goal 4** (BMPs). However, because of the long timeframe required to conduct multi-year BACI studies, the need for voluntary interim BMPs was identified as a need for the electric utility industry by APLIC member utilities. In October 2012, APLIC convened a sage-grouse/power line meeting and invited representatives from electric utilities, environmental organizations, academia, state and federal agencies, and other interested stakeholders. The group agreed there was a need to develop electric utility-specific BMPs to assist utilities in avoiding and minimizing potential impacts to sage-grouse. The BMP document is scheduled to be released in the fall of 2014 and will be available at (www.aplic.org).

The BMP document is a result of the collaborative efforts among participating utilities and agencies is intended to provide consistent and implementable actions that comply with and enhance sage-grouse specific conservation measures, recommendations and requirements contained within federal and state management plans. These BMPs are not intended to replace or conflict with existing agency plans, but rather provide additional detail and benefit specific to electric transmission and distribution infrastructure and related actions. Like APLIC's other guidance documents, APLIC members and agency partners will collaborate on future document updates and revisions. These BMPs will be evaluated and updated as needed to reflect future research and best practices.

Funding Tall Structure Research Efforts

Funding for the research would be through the use of compensatory mitigation dollars intended to address unknown impacts. This approach is beneficial and supported by state and federal resource agencies in order to provide data on a large geographical scale to inform management decisions. The EOC discussed the use of the RISCT recommendation that targeting funds for research was appropriate to better evaluate transmission line impacts. Discussions concluded, "…that direct impacts will be mitigated, unknown impacts researched and companies will mitigate up to a pre-set agreement amount." The EOC unanimously approved this recommendation on September 13, 2011.

Benefits of Implementing a Tall Structure Research Effort

Implementation of the Protocol across multiple landscapes and sage-grouse populations provides a scientifically valid mechanism to address the unknown affects of tall transmission structures on sage grouse at a landscape level. Project-level implementation of this research is an accepted, effective mechanism to address unknown effects within a comprehensive mitigation plan for such projects. This research is not intended to be a replacement for activities addressing direct impacts to habitat, including avoidance, minimization and mitigation measures. Implementation of the EOC supported research protocol and conducting studies will benefit the various stakeholders responsible for sage-grouse conservation.

BLM: This research will go a long way to support BLM managers that are initiating or revising land use plans to address sage-grouse habitat. Having access to a science-based body of knowledge will allow for improved decision-making with respect to the designation of energy corridors and the siting of transmission projects. Lastly, the agency will be able to adopt a suite of Best Management Practices that will ensure sage-grouse and their habitat is adequately protected in the long-term.

U.S. Fish and Wildlife Service: The extensive nature of the pre and post construction research approach will provide scientific information that will inform status review and conservation planning analyses for both local field office reviews and Landscape Conservation Cooperatives. The research will also generate science-based knowledge on which to develop regulatory mechanisms to ensure the conservation of the species on public lands.

State Agencies: The state wildlife agencies have the statutory authority for sage-grouse conservation. States are responsible for the protection, propagation, restoration and management of the species. State wildlife agencies generally have no regulatory authority over land use activities; they do however, provide consultation to permitting agencies. This research will provide a scientific basis to predict the effects of transmission lines on sage-grouse vital rates, changes in habitat quantity, quality and utilization and fragmentation relationships. Additionally, these studies should provide metrics on cumulative impacts of development on populations. BMPs resulting from these studies should provide appropriate responses to future siting, construction and operation of transmission lines.

The research protocol was developed to be comparable to the wind energy impact studies and will provide vital rates which will be directly comparable to the wind energy impact studies. The combination of these two programs into a single database of sage-grouse vital rates will provide biologists with large geographical scale measurements that have been lacking. These research data may be compared to data collected by management agencies that may be used to adjust analysis on a regional basis.

The quantification of unknown impacts on sage-grouse populations from transmission lines will help wildlife agencies evaluate risks and opportunities from the development activity. Frameworks identified in the Protocol will help agencies provide scientifically based recommendations to permitting agencies and utility companies.

Utility Industry: Increasing demands for energy and for the development of renewable and alternative energy sources require the construction of new high voltage transmission lines to deliver this electricity. Currently, site selection and authorization of these new facilities is difficult and time consuming for all parties. A major concern both developers and agencies face prior to project approval is how to assess and mitigate the unknown impact of these new tall structures on sage-grouse.

Utilities recognize that there are few peer-reviewed, experimental studies that address the effects of tall structures on sage-grouse. Support within the industry and by lead authorizing agencies for additional research to effectively assess the effects is needed if such research is going to be implemented on a project basis. The current lack of scientifically-based information could lead authorizing agencies, in their impact analyses, to assume a suite of impacts are occurring and require costly and potentially unnecessary mitigation. Research on tall structures is intended to lead to improved siting criteria for new power lines, consistent impact analysis criteria and best management practices with the objective of conserving sage-grouse range wide. Research following the approved Protocol could be conducted range-wide on new major high voltage transmission projects where suitable sites have been identified and mutually agreed upon.

Benefits to the utility industry include implementation of the Protocol as part of a comprehensive sage-grouse mitigation plan that effectively addresses the issue of unknown impacts from tall structures, rather than relying on professional opinion to determine potential effects.

Once the research is complete and subsequent BMPs and siting criteria have been developed, benefits to the utility industry include:

- Improved siting and design criteria can be applied during the project development rather than retroactively during the impact evaluation of a project.
- More certainty and consistency in the analysis process used to evaluate the impacts a transmission line project may have on sage-grouse, thus reducing project schedule delays.
- More upfront clarity regarding mitigation actions and costs.
- Less conflict between permitting agencies and project proponents.

Research Governance

To ensure future sage-grouse/tall structure research would follow the established protocol, a governance body was established. This body consisted of a governance committee and a scientific oversight committee (SOC). The SOC role was to review and assess the multistate, replicated research to ensure compliance with the protocol and the Governance Committee’s (GC) role was to provide a coordination support to the SOC and researchers. No sage-grouse/tall structure research has been proposed that would follow the established protocol so the GC and SOC have remained inactive. It is assumed that if in the future there is a large research project that would need the support of the GC and SOC; the EOC would need to re-establish those committees. Composition of the committees in 2012 when their roles were formalized in a previous “White Paper” is listed below.

Recommended Governance Structure and Responsibilities Governance Committee (GC)
Consisting of 7-8 members: 2 each from federal agencies, state agencies, and the energy industry and a chair of the SOC. Responsibilities would include:

- Strategic oversight and general management.
- Adopt changes to the research Protocol.
- Coordination between EOC and research efforts.
- Monitor and advise the SOC.

Founding Governance Committee Members – 2012			
Agency or Organization	Name	City	State
Bureau of Land Management	Lucas Lucero	Washington	DC
US Fish & Wildlife Services	Pat Diebert	Cheyenne	WY
Wyoming Game & Fish	John Emmerich	Cheyenne	WY
Montana Fish, Wildlife & Parks	Dave Risley	Helena	MT
Western Association of Fish and Wildlife	San Stiver	Prescott	AZ
Idaho Fish & Game	Brad Compton	Boise	ID
Idaho Power	Brett Dumas	Boise	ID
APLIC Member Utilities	Jim Burruss	Salt Lake	UT
Utah Wildlife in Need (UWIN)	Bob Hasenyager	Salt Lake	UT

Science Oversight Committee (SOC)
Consisting of 4–6 members and may include independent research experts and technical advisors.

- Review pre-release requests for proposals (RFP).
- Review and recommend proposals to the GC.
- Conduct annual research review and recommend changes to Protocol.
- Quality assurance/quality control (QA/QC) of research to ensure compliance with Protocol.

Science Oversight Committee Members – 2012			
Agency or University	Name	City	State
Washington Dept. of Wildlife	Mike Schroeder	Bridgewater	WA
University of Idaho	Steve Bunting	Moscow	ID
University of Minnesota	Rocky Gutierrez	St. Paul	MN
U.S. Forest Service Research	Sam Cushman	Flagstaff	AZ
Western Association of Fish and Wildlife Agencies	San Stiver	Prescott	AZ

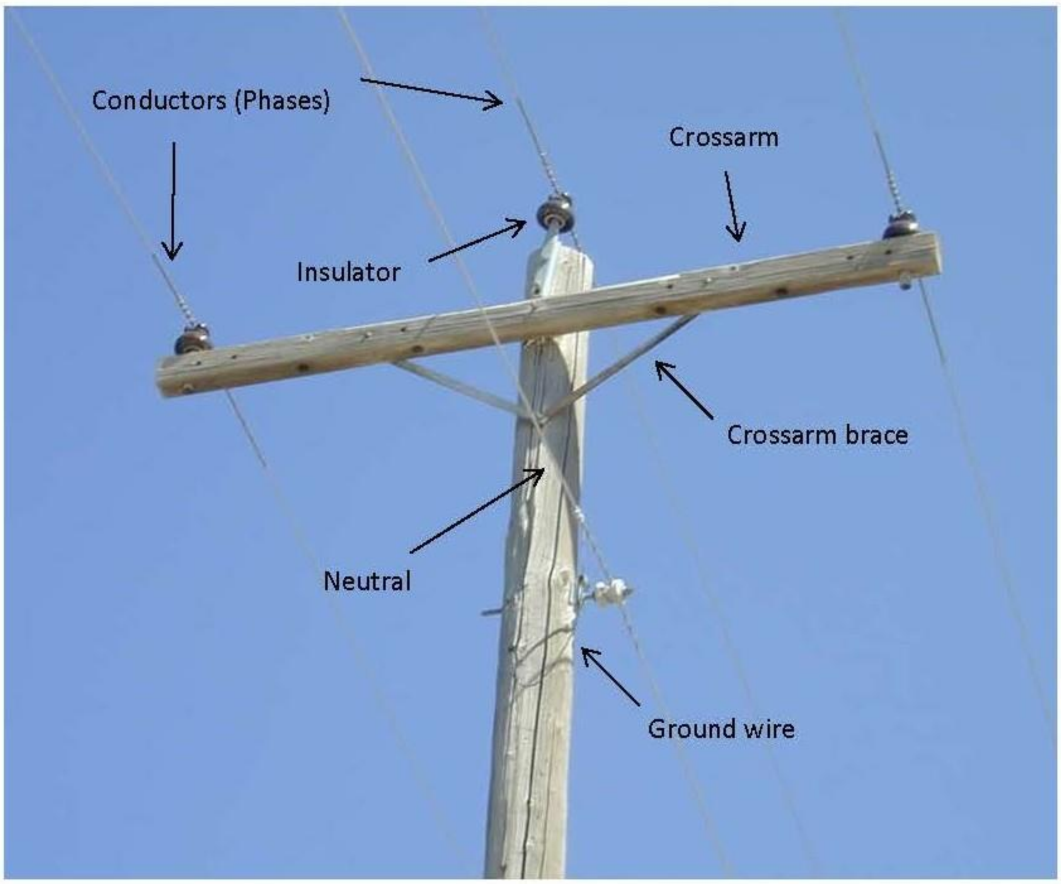
Document continues on the following page.

Appendix C. Examples of Different Power Line Configurations

Document continues on the following page.

Appendix C: Examples of Different Power Line Configurations

Terminology

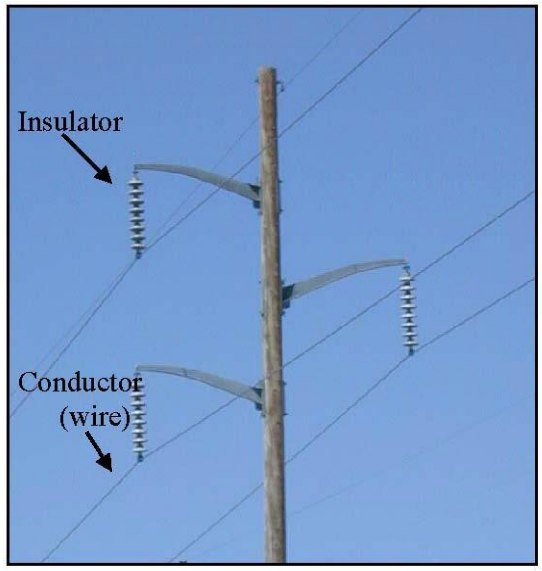


Transmission lines carry electricity from generating plants to substations. Transmission lines generally go "cross-country".

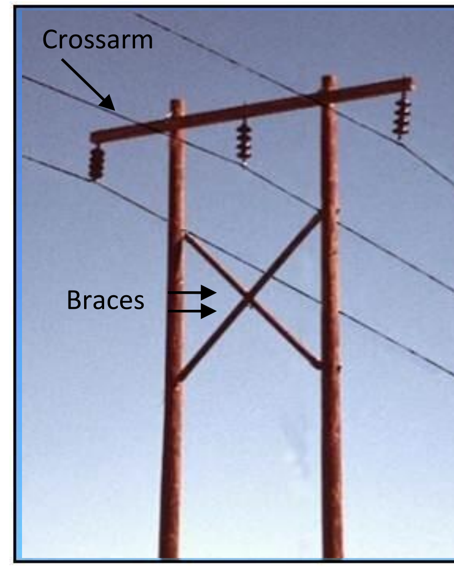
Distribution lines deliver electricity from substations to homes, businesses, farms, and are much smaller than transmission lines.

Examples of Transmission Configurations

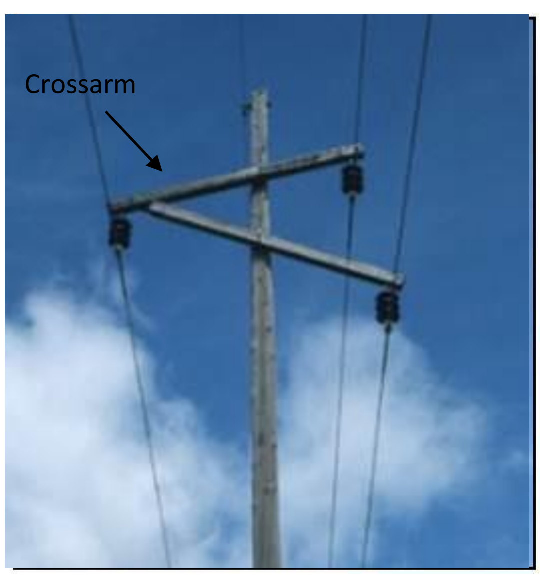
Steel lattice



Suspended insulators



H-frame



YS or wishbone

Post-mounted insulators

Examples of Distribution Configurations

Three phase tangent, 8-foot arm *(Avian-safe construction)*

Three phase tangent, 10-foot arm *(Avian-safe construction)*

Three phase tangent, 8-foot arm (*Avian-sage construction*)

Appendix D. Examples of Construction Equipment and Activities

Document continues on the following page.

Appendix D. Examples of Construction Equipment and Activities

Backhoe: 8 feet wide, 15-20 feet length, and weight 10-15 tons.

Brink skidder/Dozer: 8 – 12 feet wide, 15 - 25 feet length, and weight 15-30 tons.

Boom truck: 8 – 10 feet wide, 30 – 45 feet length, and weight 30 – 40 tons.

Bucket truck: 8 feet wide and 15 – 25 feet length.

Crane: 8 – 10 feet wide, 30 – 70 feet length, weight 20 – 35 tons.

Digger derrick: 8 – 10 feet wide, 30 – 40 feet length, and weight 25 – 30 tons.

Equipment trailer: 10 – 12 feet wide and 20 – 40 feet length.

Flatbed truck: 8 feet wide and 20 – 25 length.

Snowcat or Linetrac: 8 – 10 feet wide, 20 feet length, and weight 15 – 30 tons.

Heavy haul tractor: 8 feet wide, 18 – 25 feet length, and weight 8 – 12 tons.

Cable reel/pulling location: 8 – 10 feet wide, 25 – 40 feet length, and weight 10 – 20 tons.

Transmission line construction


Transmission line construction


Transmission line construction


Setting structure on foundation


Conductor stringing with helicopter


Two-track access road


Two-track access road


BMPs for construction near wetlands


Timber mats for access in riparian area


Overland travel route (no road improvement required)

Appendix E. Examples of a Project Checklist

Document continues on the following page.

T&D Projects — Environmental Checklist

Project Name ____

Work Order # ____

Project Description ____
____
____

Project Location ____

Project Manager ________________________ Project Engineer __________________

Project Sponsor/Estimator ___________________ Operations Manager ______________________

Construction Start Date ____________________ Construction Completion Date ______________

Contact Environmental Services when the proposed project or activity will include or result in:
(Circle ALL that apply)

1. Activities on lands owned, controlled, or managed by Federal (BLM, Forest Service, etc), State, Local, or Tribal entities
2. Any ground disturbing activities in or near any waterbody or drainage including wetlands, canals, ditches, streams or rivers, or aerial crossings
3. Cumulative ground disturbance within entire project area equal to or greater than one acre. This includes temporary use, staging areas, multi-use yards, etc
4. Access road development, improvement, realignment, or relocation
5. Alteration of a known sensitive environmental area or potential loss of habitat
   a. Identify: ____
6. Any known threatened, endangered, sensitive, or species of concern within or near project area
   a. Identify: ____
   b. Sage-Grouse: Project is located within Sage-Grouse Core Area (for Wyoming refer to PowerMap)
7. Nest removal or relocation
8. Installation or modification of power lines in: non-urban areas (Y / N) urban areas (Y / N)
9. Removal and disposal of treated wooden poles
10. Installation or modification to any substation or generation facility
11. Removal of oil-filled equipment (including circuit capacitors), concrete slabs, or soil from any substation
12. Transport of hazardous substances (SF6, argon, batteries, fuels in portable tanks, etc.)
13. Transfer of substation property ownership and or purchase of lands
14. Demolition or removal of buildings and/or associated components (i.e. insulated wires, etc.)
15. Surface-disturbing activities including clearing/grading, drilling or excavation, material hauling, etc. within Utah, Davis, or Salt Lake County, or City of Ogden

Submit Checklist to Brian King Date Submitted ______________ Submitted by ______________

Environmental Staff Comments: ____
____
____

Environmental Contacts:
Brian King ext 4831 / Robert Hamilton ext 4184 / Scott Edmisten ext 4097