4.0 ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

Environmental consequences of construction, operation, and maintenance of the proposed Windplant project are discussed below for each potentially affected resource under each alternative. Discussions of impacts that can be reasonably expected from project implementation are included, and mitigation measures and residual impacts are discussed, where appropriate. Project-wide mitigation measures, presented in Section 2.1.11, are part of the Proposed Action and Alternative A, and impact analyses assume that these mitigation measures would be effectively implemented. Additional mitigation measures are recommended for some resources to further minimize impacts; however, the BLM lacks authority to enforce some of these measures on private lands. Nevertheless, KENETECH and PacifiCorp have committed to implementing the proposed project with public safety and environmental consciousness throughout the KPPA and for the LOP insofar as landowner preference and agreement allow.

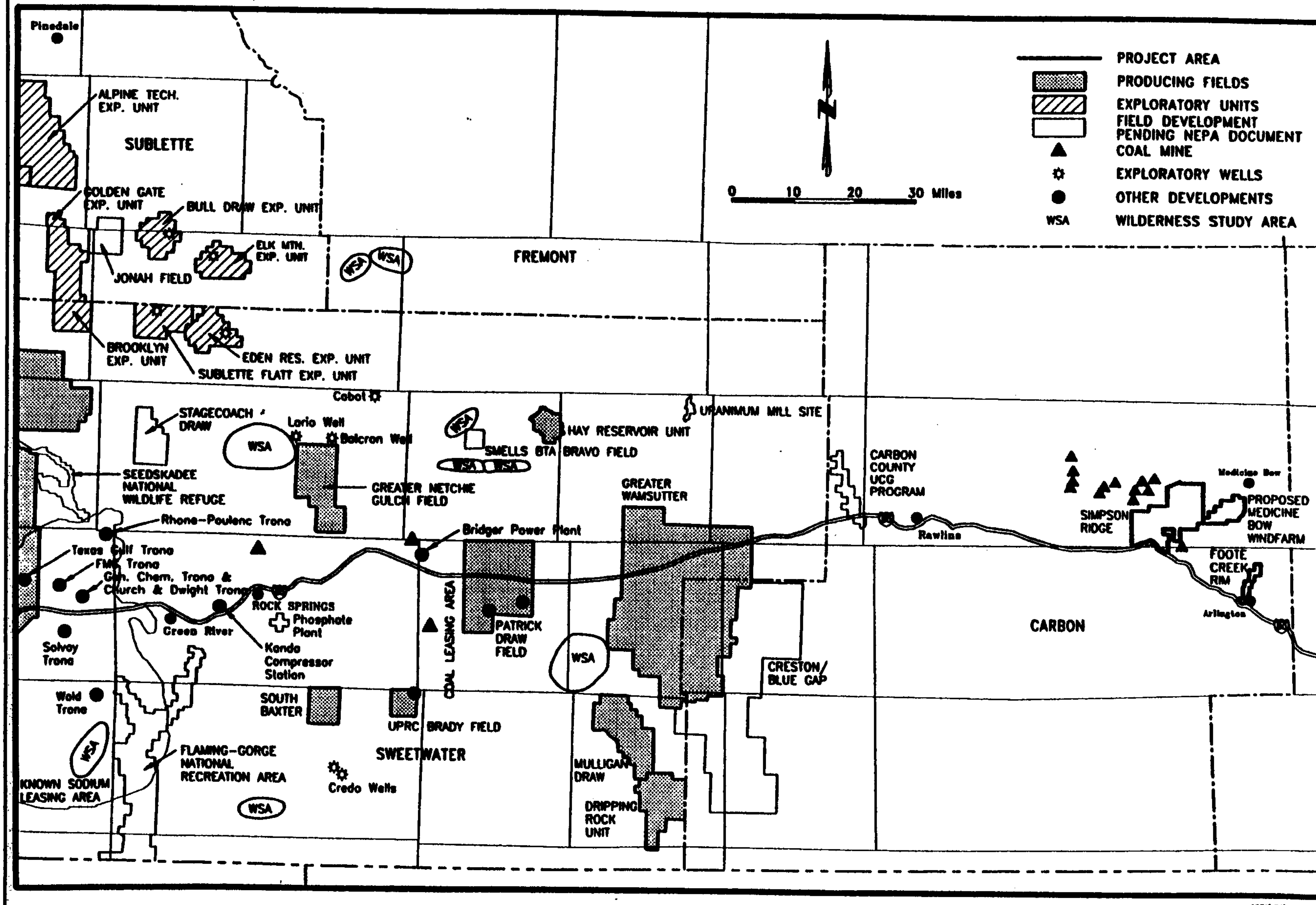
An environmental consequence or impact is defined as a modification of the existing environment brought about by development activities. Impacts can be beneficial or adverse, can be a primary result of the action (direct) or a secondary result (indirect), and can be permanent or long-lasting (long-term) or temporary and of short duration (short-term). Impacts can vary in degree from only slightly discernible to a total change in the environment.

All impacts described in this chapter are post-mitigation impacts. Mitigation measures are summarized in Section 2.1.11, detailed in this chapter, and recapitulated in Chapter 5.0. These mitigation measures are built into the Proposed Action and Alternative A to reduce the level of expected impacts. All mitigation measures would become a binding part of the ROW grant.

Short-term impacts are effects on the environment that occur during and immediately after the conclusion of construction and final testing. Although short in duration, such impacts are normally obvious and disruptive. For this project, short-term impacts are defined as lasting five years or less. Long-term impacts are changes made in the environment during construction and operation of the project that remain longer than five years. Impacts that remain for the LOP or after final reclamation has been completed would be considered long-term.

Potential impacts for this project were classified into five levels: significant, moderate, negligible, no impact, and beneficial. Significant impacts (as defined in CEQ guidelines 40 C.F.R. 1500-1508) are effects that are the most substantial, and therefore, should receive the greatest attention in decision-making. Impact significance criteria are given for those affected resources where significance criteria can be reasonably supported (i.e., by scientific or regulatory considerations). Moderate impacts do not meet the criteria to be classified as significant but nevertheless result in a degree of change that is easy to detect. Moderate impacts have the potential to become significant (e.g., disturbance within big game crucial winter range) if not adequately mitigated. Negligible impacts cause little or no effect to the existing environment and cannot be easily detected. Beneficial impacts are those that provide desirable situations or outcomes, while undesirable impacts are those that do not. Throughout this chapter, all impacts are considered undesirable unless identified as beneficial.

Cumulative impacts are those that result from the incremental impacts of the proposed project added to past, present, and reasonably foreseeable future actions. The area considered for cumulative impacts varies depending on the resource being analyzed, but includes, at a minimum, the entire KPPA. For many resources (e.g., big game, raptors) and socioeconomic impacts, the cumulative impact analysis includes areas outside the KPPA. Map 4.1 shows locations of developments in southern Wyoming that are



Map 4.1 Map of Proposed and Existing Development in Southern Wyoming.

mentioned in the cumulative impacts analysis presented in this chapter.

Cumulative impacts are described for each resource. The analysis is based on existing information available for past, present (i.e., the proposed project), and reasonably foreseeable future developments in and adjacent to the KPPA. The only reasonably foreseeable project in the area is the possible development of a windfarm near Medicine Bow. An application to use approximately 10 sections of public land for windfarm development has been received by the BLM. This project would occupy approximately 13,440 ac; total disturbance is expected to be 1,344 ac.

Past use of the KPPA has included livestock and wildlife grazing and foraging, gas and oil development and production, coal mining, recreation, and transportation. These uses, except for coal mining, continue through the present and are anticipated to continue into the reasonably foreseeable future. The extent of existing and proposed disturbance within the KPPA under the Proposed Action and Alternative A is presented in Tables 2.1(a) and 4.1. The maximum total acreage disturbed by the proposed project would be 1,787 ac initially and 715 ac for the LOP.

Surface coal mining in the Hanna Basin, approximately 5 mi (8 km) north of the KPPA, has disturbed approximately 18,180 ac, which is considered in the analysis of cumulative impacts for some resources (e.g., air quality, vegetation, soils, land use, wildlife). While many of the mines are nearing the end of their economic life or are almost fully reclaimed, some mining will continue in the near future. Approximately 12,439 ac have been reclaimed, leaving 5,741 ac disturbed. Since potential future surface and subsurface coal mine expansions beyond currently permitted levels cannot be adequately quantified, future coal mine-related disturbances shall, for the purpose of this analysis, be considered limited to currently permitted levels, or 22,598 ac.

The No Action Alternative would require the BLM to deny issuance of a ROW grant. This alternative would essentially maintain the existing condition of the environment within the KPPA. No immediate impact to the existing environment would occur because no additional ground would be disturbed. The No Action Alternative is not expected to result in direct development of another energy source within the KPPA, the GDRA, or the area serviced by BPA, PacifiCorp, Tri-State, PSCo, or EWEB (Section 2.3).

Impacts of the Proposed Action, Alternative A, and No Action, and mitigations for development activities are summarized in Table 2.11 and discussed in detail below.

4.1 PHYSICAL RESOURCES

4.1.1 Climate and Air Quality

4.1.1.1 Significance Criteria

Significance criteria for impacts on climate were not established because no climatic impacts are expected [except indirectly through beneficial air quality impacts (see Section 4.1.1.2, Air Quality)]. However, impacts on snow distribution are discussed in this section due to possible moderate impacts on other resources (i.e., geologic hazards, soils, hydrology, vegetation, and wildlife).

Impacts to air quality would be considered significant if project activities result in a violation of federal and/or state air quality attainment standards (WDEQ 1989).

4.1.1.2 Proposed Action

Climate. Because appropriate snow removal methods would be used to minimize or prevent berming along roads, direct impacts of snow redistribution would probably be negligible for the first phases of development but could be moderate for the full 500-MW Windplant. Three direct impacts on snow accumulation patterns resulting from Windplant development are possible (Tabler and Associates 1994):

Table 4.1 Proposed and Existing Disturbance Within the KPPA.

Proposed Disturbance	Phase I 70.5 MW		Foote Creek Rim 200 MW		Simpson Ridge 300 MW		Full Windplant 500 MW		Alternative A 300 MW	
	New	LOP	New	LOP	New	LOP	New	LOP	New	LOP
Total	319	68	553	176	1,234[1]	539	1,787	715	1,146	431

Existing Disturbance	Foote Creek Rim Area (ac)	Simpson Ridge Area (ac)	Alternate 1 (ac)	Alternate 2 (ac)	Alternate 3 (ac)	Total
Roads[2]	4	154	2	2	4	166
Pipelines[3]	12	229	<1	<1	<1	241
Telephone cable[3]	22	0	<1	0	0	22
Oil & gas wells[4]	3	0	2	0	5	10
Total	41	383	4	2	9	439

[1] Does not include disturbance due to the 230-kV transmission line or Miner's substation expansion because these disturbances would occur during the development of Phase I.
[2] Assumes an average road disturbance width of 48 ft (14.6 m).
[3] Assumes a 50 ft (15.2 m) initial disturbance width.
[4] Assumes a 1.5 ac disturbance area per well and includes active wells only.

- increased snow accumulation within and downwind of WTG arrays,
- localized snowdrifts formed by ancillary structures (e.g., downtower boxes, padmounted transformers, security fences), and
- snowdrifts caused by roads and snow-plowing operations.

Indirect impacts would occur due to the effects of snow distribution on geologic hazards (Section 4.1.4), soils (Section 4.1.6), hydrology (Section 4.1.7), vegetation (Section 4.2.1), and wildlife (Section 4.2.3).

Wind turbine arrays could increase the overall snow cover in the developed area. A single row of operating turbines constitutes a porous barrier that reduces wind speeds and surface shear stress for some distance downwind, which could cause increased snow deposition downwind of turbine strings. The effect on snow cover would depend on the geometry and aerodynamic resistance of the WTG array (Tabler and Associates 1994).

When stationary, the WTG blades would not constitute a large area to slow windspeeds. However, the drag of the turning rotor would be proportional to the swept area (Hoerner 1965), and with 108-ft (33-m) diameter blades sweeping 9,200 ft^2 (855 m^2) at a spacing of 162 ft (49 m) apart, the ratio of disturbed vs. undisturbed airflow is approximately 0.42, exclusive of the support towers (Tabler and Associates 1994). The wake generated by a single string of WTGs on an 80-ft (24-m) tower would reach the ground at approximately 3.7 rotor diameters [400 ft (122 m)] downwind. Wakes from individual WTGs would coalesce at approximately 4.0 blade diameters, or at approximately the same distance, downwind. The potential drift created by a single string would extend beyond the point of coalescence approximately 2,800 ft (853 m), or approximately 35 times the height of the towers (Tabler 1986). Although the location and the extent of the affected area can be estimated from the above relationships, it is not possible to predict the depth of snow accumulation, or even determine if it would be detectable. Factors such as snowfall, blowing, and evaporation would influence the possible development of downwind drifts.

The effects of two or more rows of WTGs spaced 1,080 to 1,620 ft (329 to 494 m) apart could have a combined effect greater than that of a single row. Scale model tests or full-scale observations would be required to determine effects of multiple rows on snow distribution. Based on preliminary analysis of aerodynamic drag data provided by KENETECH, it is likely that snow would accumulate between arrays, especially arrays of four or more rows of turbines (Tabler and Associates 1994).

In addition to possible snow deposition within and downwind from WTG arrays, horseshoe-shaped snow drifts will form around tower bases [base of each leg is approximately 11.0 ft (3.4 m) in diameter]. The size and shape of drifts in the vicinity of the WTGs will depend on the placement of downtower boxes. The overall drift would be smaller if downtower boxes are incorporated into the base of the tubular support or located on the downwind side, as opposed to being located alongside the tower base.

The size of a drift formed by a solid three-dimensional rectangular object varies with its height and width. A key-hole shaped bare area would extend around and downwind of the downtower boxes and padmount transformers, bordered by wing-shaped drifts that would extend for considerable distances downwind. Maximum depth of these drifts is expected to be about 3 ft (1 m). The total mass of snow stored in these drifts would represent only a small fraction of the total snow transport across the project area.

Drifts caused by downtower facilities could obstruct vehicular travel on downwind service roads. If drifts across roads are disturbed due to traffic or plowing, the resulting berms along the roadsides could induce snow deposition, which in turn, could cause drifts to grow in depth and lateral extent.

Significant snow accumulation may occur both upwind and downwind from chain-link fences such as those that would be used to fence Windplant substations. These drifts may affect traffic on adjacent service roads.

If roads are properly designed and maintained as described below, service roads paralleling turbine strings would have a negligible or moderate impact on snow distribution. Potentially significant impacts would occur if roads are improperly designed and maintained. Slow-moving snow removal equipment, such as graders, could form berms along the roadside that would be traps for blowing snow; these drifts typically grow rapidly as subsequent snow removal operations increase their height. Where feasible, roads would be plowed in a downwind direction using a wing plow to reduce the height of snow berms. Because snow particles freeze together, disturbed snow hardens, and thus becomes resistant to wind erosion. Roads would be elevated above surrounding terrain, wherever possible, so that wind would keep roads relatively free from snow accumulation and encroachment of horseshoe-shaped drifts formed by tower bases and downtower facilities would be minimized. Even in the absence of snow removal operations, vehicles driving through newly fallen snow can initiate subsequent drifting problems because tires form ridges that resist wind erosion and induce snow deposition.

Air Quality. A recent analysis of resource acquisition by Pacific Northwest Utilities showed that between 1989 and 1994, negotiations were completed for 1,276.5 average MW of new resources. Natural gas-fired generation projections accounted for 84% of the total (Conservation Monitor 1994). If this trend continues, there appears to be at least an 84% probability that if the Windplant project is not constructed, its output will be replaced by new gas-fired generation emitting large amounts of carbon dioxide (CO_2).

Using windpower instead of burning fossil fuels to generate electricity would have "beneficial" impacts on air quality because greenhouse gases and other pollutants emitted by conventional fossil fuel combustion would not be produced. The term beneficial is used to describe the favorable impact of using a nonpolluting resource to generate electricity; it is not intended to reflect proactive air quality improvement (i.e., cleanup). In the U.S., annual CO_2 emissions due to fossil fuel burning totaled 5.7 billion tons (5.1 billion metric tons) in 1989; sulfur dioxide (SO_2) emissions in 1990 totaled 15.6 million tons (14.2 million metric tons), and NO_x emissions totaled 8.0 million tons (7.3 million metric tons) (Table 4.2). These pollutants, among others, create biological hazards including, but not limited to, direct human health effects, acid deposition, and potential global warming. Compared with an oil-burning power plant (generating 500 MW of electricity), the proposed 500-MW Windplant would prevent the release of 1.0 million tons (0.9 million metric tons) of CO_2, which is 0.018% of annual U.S. CO_2 emissions; 573.0 tons (520.0 metric tons) of SO_2 (0.004%), and 716.0 tons (649.7 metric tons) of NO_x (0.009%). Comparing wind with gas- and coal-fired plants, similar reductions in pollutant emissions would occur (Table 4.2). These reductions are some of the principal benefits of using non-polluting resources for electricity generation, and result in a beneficial impact.

In addition to the biological costs of pollution, society is bearing a substantial economic cost. The costs of pollution are difficult to quantify but include additional health care, development and utilization of pollution prevention devices (i.e., SO_2 scrubbers for coal-fired plants), and programs to reduce emissions (e.g., the Acid Deposition Control Program). Costs to society for several major pollutants, estimated by the Public Utility Commission of California, are shown in Table 4.3 (SMUD 1993). The 500-MW Windplant could result in a cost savings of $26.0 million to $331.1 million per year over oil-, gas-, and coal-fired power plants.

In the KPPA, short-term increases in particulate dust and trace gas emissions would result from construction and O&M activities; however, the project would remain in compliance with

Table 4.2 Estimated Reduction in Pollutant Emissions and Comparison with U.S. Annual Emissions from Man-made Sources.

Pollutant	Annual U.S. Emissions[1,2] Tons	Metric Tons
SO_2 (Electric utilities, 1990)	15,600,000	14,156,000
CO_2 (Fossil fuel burning, 1989)	5,662,076,000	5,138,000,000
NO_x (Electric utilities, 1990)	8,000,000	7,256,000

	Reduction in Emissions		% of Annual U.S. Emissions	LOP Emissions Reductions	
	Tons/Year	Metric Tons/Year		Tons	Metric Tons
Wind vs. an oil-fired plant[3]					
SO_2 (Electric utilities, 1990)	573	520	0.004	17,190	15,599
CO_2 (Fossil fuel burning, 1989)	1,003,000	910,163	0.018	30,090,000	27,304,899
NO_x (Electric utilities, 1990)	716	650	0.009	21,480	19,492
Wind vs. a gas-fired plant[3]					
SO_2 (Electric utilities, 1990)	n.d.[4]	n.d	n.d.	n.d.	n.d.
CO_2 (Fossil fuel burning, 1989)	2,093,760	1,899,964	0.037	62,812,800	56,998,910
NO_x (Electric utilities, 1990)	260	236	0.003	7,800	7,078
Wind vs. a coal-fired plant[5]					
SO_2 (Electric utilities, 1990)	12,500	11,343	0.080	375,000	340,290
CO_2 (Fossil fuel burning, 1989)	1,500,000	1,361,161	0.026	45,000,000	40,834,845
NO_x (Electric utilities, 1990)	3,750	3,403	0.047	112,500	102,087

[1] National Acid Precipitation Assessment Program (1993).
[2] U.S. Congress (1991).
[3] SMUD (1993).
[4] n.d. = No data.
[5] Personal communication, June 1994, with Bruce Morely, KENETECH.

Table 4.3 Estimated Reduction in Pollutant Emissions and Environmental Costs by Operation of a 500-MW Windplant Compared with Oil-, Gas-, and Coal-fired Plants.

Pollutant	Reduction in Emissions: Tons/Year	Reduction in Emissions: Metric Tons/Year	Cost/Ton (dollars)	Annual Cost (dollars)
Wind vs. an oil-fired plant[1]				
SO_2	573	520	18,300	10,485,900
CO_2	1,003,000	910,163	7	7,021,000
NO_x	716	650	24,500	17,542,000
CO	50	45	920	46,000
PM10	100	91	5,300	530,000
Reactive organic gases	38	34	17,500	665,000
Total Annual Cost Reduction				36,289,900
Wind vs. a gas-fired plant[1]				
SO_2	n.d.	n.d.	18,300	n.d.
CO_2	2,093,760	1,899,964	7	14,656,320
NO_x	260	236	24,500	6,370,000
CO	180	163	920	165,600
PM10	210	190	5,300	1,113,000
Reactive organic gases	210	190	17,500	3,675,000
Total Annual Cost Reduction				25,979,920
Wind vs. a coal-fired plant[2]				
SO_2	12,500	11,343	18,300	228,750,000
CO_2	1,500,000	1,361,161	7	10,500,000
NO_x	3,750	3,403	24,500	91,875,000
CO	n.d.	n.d.	920	n.d.
PM10	n.d.	n.d.	5,300	n.d.
Reactive organic gases	n.d.	n.d.	17,500	n.d.
Total Annual Cost Reduction				331,125,000

[1] SMUD (1993).
[2] Personal communication, June 1994, with Bruce Morely, KENETECH.

Wyoming Air Quality Standards and Regulations and the Clean Air Act. Construction impact would be moderate, and LOP impacts would be negligible. The WDEQ-AQD reviewed the project description and determined that no air quality construction permit would be required to construct and operate the proposed Windplant (personal communication, December 1994, with Charles Collins, WDEQ-AQD).

O&M particulate emissions from pickup trucks traveling on gravel roads were estimated using the AP-42 Section 11.2.1 emission factor for unpaved roads (EPA 1993). The calculations are sensitive to the estimated silt content in the gravel used for the road surface. Because the gravel source for road surfaces in the KPPA is, as yet, undetermined, precise silt content is not available. A value of 5.1% silt was measured along a haul road in southwestern Wyoming. To be conservative, a value of 10% silt was used to make the estimates herein. It was estimated that there would be 59,370 vehicle mi (95,544 km) traveled per year for the first phase, and 249,354 mi (401,285 km) per year for the 500-MW Windplant (personal communication, January 1995, with Marci Proutt, KENETECH). Emissions would be controlled using an approved suppressant (i.e., petroleum resin) with a control factor of about 80%. Application of approximately 0.2 gal/m^2 (0.8 liters/m^2) would control dust emissions from gravel roads within the KPPA by about 80% (EPA 1993). Using these approximations, particulate emissions from the first phase O&M would be 16.6 tons (15.1 metric tons) per year TSP and 7.0 tons (6.4 metric tons) per year of particulates $\leq$ 10 microns (PM10). For O&M of the 500-MW Windplant, TSP emissions would total 69.4 tons (63.0 metric tons) per year and PM10 emissions would total 31.2 tons (28.3 metric tons) per year.

Hydrocarbons, NO_x, CO, CO_2, and SO_2 emissions in the KPPA would temporarily increase during construction and O&M. No CO_2 emissions exceeding suggested health practice standards [5,000 parts per million (ppm) annual average (American Council of Governmental Industrial Hygienists 1980)] would occur.

The occurrence of corona discharge from the 230-kV transmission line could result in production of gaseous effluents, including ozone and NO_x. However, transmission lines produce only very small amounts of these gaseous effluents (Miller and Kaufman 1978), and thus, air quality impacts from the transmission line would be negligible for the LOP and beyond.

Activities associated with the Proposed Action would not produce emissions that exceed Class II PSD increments, National Ambient Air Quality Standards, or Wyoming Ambient Air Quality Standards; and therefore, impacts to regional air quality would be moderate during construction and negligible for the LOP.

4.1.1.3 Alternative A

Climate. Under Alternative A, Windplant impacts on snow redistribution would be reduced by approximately 40% from the Proposed Action, depending upon facilities locations within the KPPA. If facilities are located in natural snow accumulation areas, impacts may not be reduced by the full 40%; conversely, because fewer turbines would be erected, it would be easier to avoid areas where impacts from snow deposition would cause moderate or significant impacts.

Air Quality. Construction of a 300-MW Windplant would result in a reduction of between 30 tons and 1.3 million tons (27.2 metric tons-1.3 million metric tons) of common pollutants (Tables 4.2 and 4.3); i.e., the air quality benefits would be reduced by approximately 40% from the Proposed Action. Similarly, by reducing the savings in pollutants, economic benefits to society of using a non-polluting resource also would be reduced by approximately 40% (Table 4.3).

Because similar mitigation measures would be used under Alternative A as under the Proposed Action, impacts under this alternative would be moderate during construction and negligible to beneficial for the LOP. In addition, since 556 fewer turbines would be erected (and fewer associated roads and distribution and communications lines), potential adverse air quality impacts would be reduced by about 40%. Vehicle miles traveled during O&M for Phase I would be the same as for the Proposed Action, but reduced to 149,612 mi (240,771 km) for the 300-MW Windplant. Suppressant measures similar to the Proposed Action would be used; therefore, TSP emissions under Alternative A would total 41.6 tons (37.7 metric tons) and PM10 emissions would total 18.7 tons (17.0 metric tons). Transmission line emissions also would be similar to the Proposed Action, and thus, negligible for the LOP.

4.1.1.4 No Action

Climate. Under the No Action Alternative, no impacts on snow distribution would occur.

Air Quality. Under the No Action Alternative, potential air quality benefits could be lost if the demand for electricity is met using fossil fuels. Therefore, the No Action Alternative could result in more fossil fuel combustion and the release of air pollutants. However, there would be no incremental increase in air quality impacts within the KPPA from the proposed project under the No Action Alternative.

4.1.1.5 Cumulative Impacts

Climate. Existing roads, residences, fences, oil and gas wells, and other developments are not sufficiently large or widespread to cause substantial snow accumulation; therefore, cumulative impacts from Windplant development on snow redistribution would be similar to impacts from the Proposed Action. The Medicine Bow windfarm, which borders the eastern edge of the Simpson Ridge area, would also cause snow redistribution and would add cumulatively to altered snow distribution patterns.

Air Quality. Parts of the U.S. and many other developed countries in the world are facing severe air pollution problems due to industrialization. Governments around the globe are instituting programs or setting goals to reduce pollution emissions and improve air quality (U.S. Congress 1991, Cogan 1992, National Acid Precipitation Assessment Program 1993). The U.S. currently emits about 20% of the world's CO_2, 40% of which comes from oil combustion, 34% from coal, and about 18% from natural gas (U.S. Congress 1991). If current practices continue, estimated CO_2 emissions would increase to 7.6 billion tons (6.9 billion metric tons) annually by the year 2015 (Figure 4.1). By implementing moderate or strict emission control measures, this amount could be substantially reduced. Moderate measures would include, for example, tree planting, conservation measures (e.g., better building insulation, heating and cooling efficiency, improved automobile efficiency, streamlined traffic patterns, ride-sharing), and electric utility improvements (e.g., better efficiency in fossil fuel-fired plants, upgraded hydroelectric plants, ***utilization of non-fossil fuel resources***, and application of CO_2 emission standards) (U.S. Congress 1991). Strict measures would be similar, but a greater reduction (as a percent of current levels) would be targeted. While none of these measures individually would amount to target reductions, the cumulative effects of combined measures would substantially reduce emissions in the U.S.; the proposed Windplant would contribute to annual reductions (Table 4.2). The effects of 30 years of Windplant operation would amount to an emissions reduction of 30.0-62.8 million tons (27.3-57.0 million metric tons) of CO_2 compared with coal, oil, or gas.

While the U.S. and other developed countries already face regional pollution problems and are implementing programs to improve air quality, other countries such as China and Russia are only beginning to develop their coal reserves, and may soon surpass U.S. emissions (U.S. Congress 1991). A major contributor to the observed increases in global atmospheric CO_2 concentrations (Figure 4.2) (and other gases, including greenhouse gases) is coal combustion, which produces more CO_2 than other fossil fuels. The effects of greenhouse gases [e.g., CO_2,

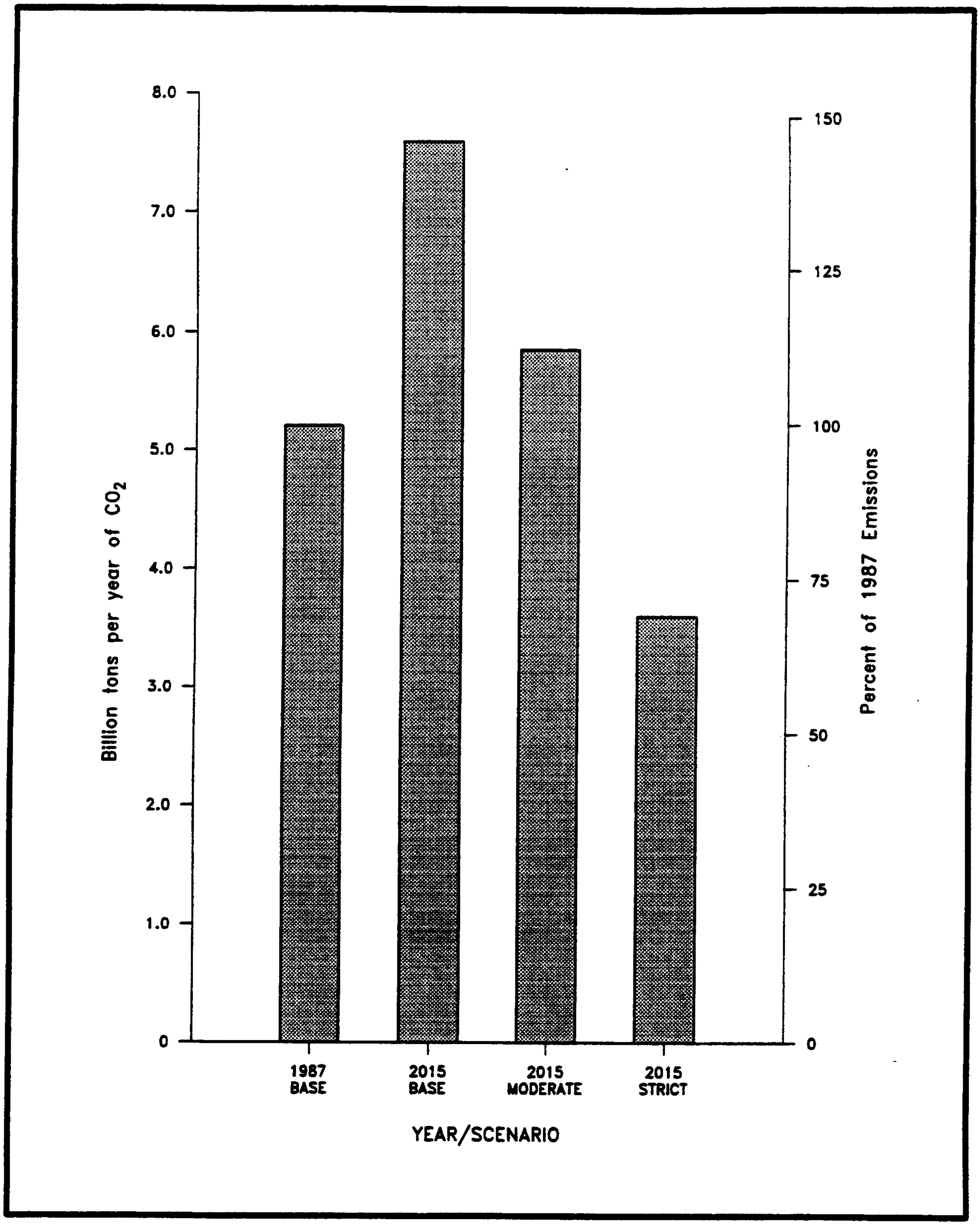


Figure 4.1 1987 U.S. CO_2 Emissions; 2015 Projected Emissions Without Controls, with Moderate Controls, and with Strict Controls.

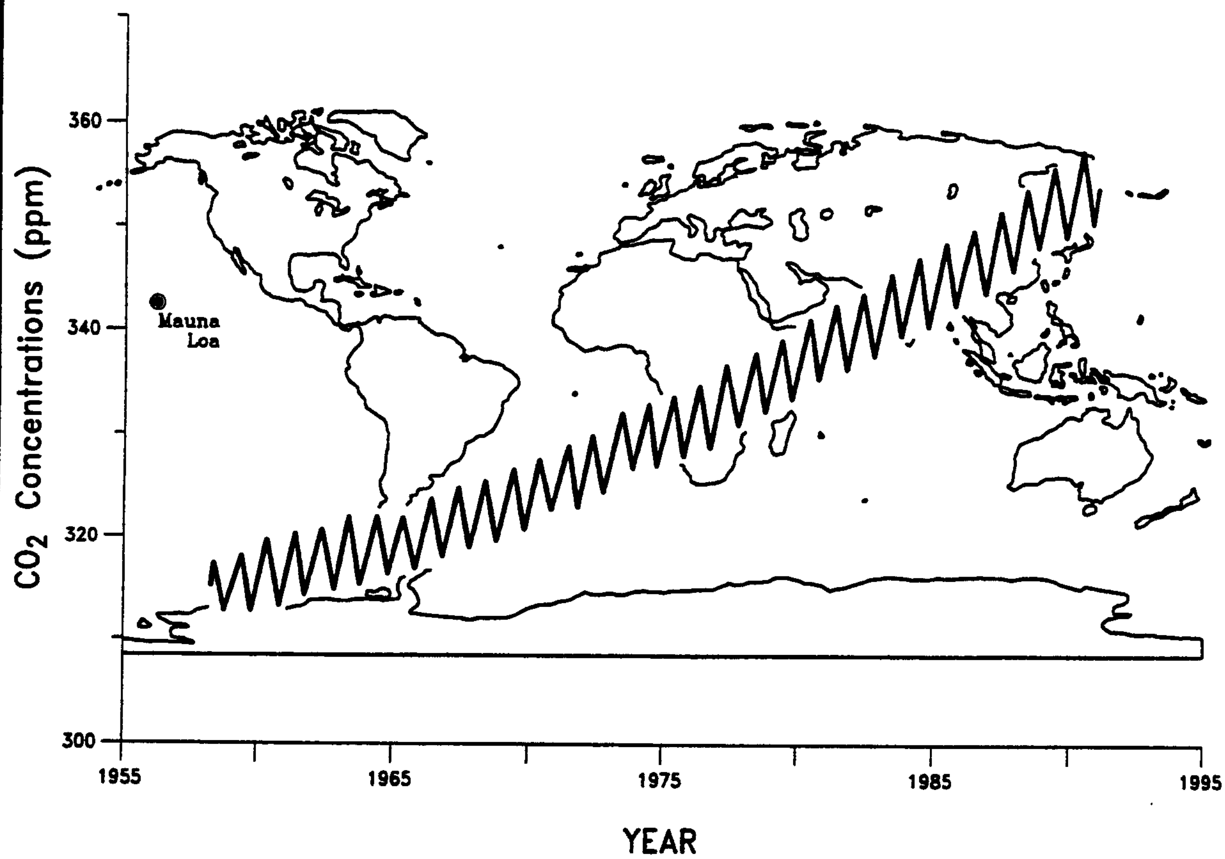


Figure 4.2 Monthly Atmospheric CO_2 Concentrations, Mauna Loa, Hawaii (Modified from Cogan 1992).

nitrous oxide (N_2O)] on the earth's climate is still controversial. Some of the mechanisms by which earth's ecosystems absorb or convert excess CO_2 are understood, but the long-term effects on climate cannot be determined (Cogan 1992). However, the increase in CO_2 is a global phenomenon that has accelerated since the industrial revolution, and thus, fossil fuel burning in one part of the world (e.g., the U.S., Russia, China) affects the globe. Conversely, small, additive savings in emissions (i.e., the Proposed Action or Alternative A) also have beneficial global effects.

Another beneficial air quality/biological impact would be the reduction in SO_2 and NO_x emissions. As part of the 1990 Clean Air Act Amendments, the Acid Deposition Control Program mandates a 10.0 million-ton (9.1 million-metric ton) reduction in SO_2 emissions, to be achieved by an imposed cap on major point-sources for SO_2 (National Acid Precipitation Assessment Program 1993). The program also calls for a 2.0 million-ton (1.8 metric-ton) reduction in NO_x emissions. SO_2 and NO_x have widespread biological effects, including impacts on:

- ecosystems (i.e., on their structure and function);
- forests (e.g., the marked decline of high-elevation red spruce forests in the Northeast);
- surface waters (e.g., nitrogen inputs may exceed soil/biomass storage capacities and cause excessive nutrient leaching or acidification of surface waters)
- fisheries (i.e., episodic pulses of surface water acidification adversely affect fish populations);
- human health (effects of acidic aerosols on human health are currently being studied); and
- materials and cultural resources. Approximately 31 to 78% of galvanized steel and copper corrosion can be attributed to acidic deposition, and rates are three times faster in urban areas than in rural areas. Automobile finishes, exterior paints, etc. are also affected by acidic deposition, and many forms of rock weathering (e.g., cracking, dissolution, and discoloration) can be accelerated by acidic deposition -- this may impact historic and prehistoric cultural resources.

The Proposed Action would prevent the release of 12.5 thousand tons (11.3 thousand metric tons) per year of SO_2 and 3.8 thousand tons (3.4 thousand metric tons) of NO_x, or 0.08% and 0.05%, respectively, of the annual U.S. emissions from coal-fired plants. These reductions would contribute to the overall goal to reduce emissions of these gases and would reduce adverse impacts on resources described above.

Although expected output of the proposed Medicine Bow windfarm is not yet known, it could also contribute to overall reduction in pollution emissions.

On a regional scale, the Laramie Air Basin is a logical management unit for the adverse cumulative air quality impacts analysis. Air basins are defined by specific atmospheric flow patterns, ventilation mechanisms, and dispersion potentials, and therefore, vary in the ways they are impacted by pollutants (BLM 1987:167). Negative air quality impacts within the air basin would include numerous point-sources which emit ≥100 tons (≥91 metric tons) of pollutants per year (including the Hanna Basin coal mines), traffic on roads, road maintenance, construction and O&M associated with the Proposed Action, construction and mining associated with the proposed Jackpot Uranium Mine, and limited oil and gas or other mineral development.

Emitted pollutants would be dissipated by strong, persistent winds typical of the Laramie Air Basin. Regular maintenance of internal combustion engines and use of dust abatement techniques (i.e., using petroleum resins on gravel roads) would minimize cumulative air quality impacts resulting from project operations. Cumulative air quality impacts due to Windplant construction, coal mining in the Hanna Basin, the proposed Medicine Bow windfarm, and other developments would be moderate during construction and negligible for the LOP. The nearest Class I area (Savage Run Wilderness) is 30 mi (48 km) away from the KPPA, and is not in the direction of prevailing winds; therefore, no air quality impacts to this area are anticipated.

4.1.2 Topography/Physiography

4.1.2.1 Significance Criteria

Impacts to topography would be considered significant if disturbance permanently inhibited or substantially altered surface drainage patterns. Substantial alterations would include, for example, head cutting and/or gully formation where none existed prior to development, inhibiting surface runoff to areas where wetlands or riparian areas depended on it, or other changes which substantially redirect surface runoff. Minor surface drainage alterations caused by road ditches, erosion control devices, temporary diversions, etc., would not be considered significant. This criterion is consistent with drainage protection goals established in the GDRA RMP (BLM 1987:61-63). Negligible or moderate impacts would result from modifications to the landscape (e.g., cuts and fills, roads). The physiography (i.e., the overall character and distribution of landforms and drainage patterns) of the KPPA would not be affected by the proposed project or any of the alternatives.

4.1.2.2 Proposed Action

Impacts to topography would be negligible for the LOP and beyond. Impacts resulting from the Proposed Action would be changes to the landscape due to cut-and-fill activities used to level turbine pads and to make roadbeds. Stream crossings also have the potential for impacting surface drainage. A total of 1,787 ac (3% of the KPPA) would be disturbed during construction, and 715 ac (1%) would remain disturbed for the LOP (Table 4.1).

During construction and O&M, temporary drainage devices (e.g., ditches, culverts, waterbars, checkdams) may be required to divert runoff around Windplant facilities, but overall drainage patterns would be preserved, where feasible. Temporary sediment ponds may be needed to collect stormwater runoff during construction. Where feasible, drainage from turbine pads, turbine string corridors, and other facilities (i.e., substations) would be reconstructed during initial reclamation. Roads would be constructed following specifications in *Section 9113, Road Standards Manual* (BLM 1985, 1991), which requires restoration of surface drainage patterns with culverts, ditches, or other means, during construction. Drainage devices would be maintained regularly to ensure proper operation for the LOP. Therefore, impacts to surface drainage would be moderate during construction and negligible for the LOP. Because all disturbance areas would eventually be reclaimed, there would be no permanent impact.

Minor topographic changes would occur due to cut-and-fill activities associated with Windplant construction. Where feasible, cut-and-fill areas used during construction (e.g., staging areas along the 230-kV transmission line) would be regraded to the approximate original contour during initial reclamation. During final reclamation, all facilities would be removed to at least 6 inches below ground level, and all disturbed areas would be recontoured and revegetated. Therefore, impacts to topography would be negligible for the LOP and beyond.

4.1.2.3 Alternative A

No significant impact to topography and physiography would occur under Alternative A, and impacts would be similar to those for the Proposed Action (i.e., negligible for the LOP and beyond), but reduced by approximately 40%. New cut-and-fill disturbance under Alternative A would total approximately 1,146 ac (2% of the KPPA), and total LOP disturbance would be 431 ac (<1%) (Table 4.1).

4.1.2.4 No Action

No significant impact to topography or physiography would occur under the No Action Alternative. Existing disturbance on the KPPA totaling 439 ac (<1%) would continue for current land uses.

4.1.2.5 Cumulative Impacts

Cumulative impacts to topography in the KPPA and surrounding areas would occur from existing, proposed, and potential future roads or coal, oil, gas or other development projects. Development within and around the KPPA has and would alter surface drainage patterns; whether or not these patterns are permanently altered and development, therefore, represents a significant impact, can be argued many ways. No development would substantially alter or inhibit drainage patterns; therefore, cumulative impacts would be moderate. Coal mines create the most substantial impacts to topography within the region. Surface coal mining typically results in an overall lowering of the ground surface and a change in the distribution of various landforms. Disturbance from the coal mines would eventually total 22,598 ac if the mines expand to their currently permitted levels. Disturbance due to Windplant development (1,787 ac initially and 715 ac for the LOP) would be approximately 8% of the projected mining disturbance (3% for the LOP). The construction of 653.0 mi (1,050.9 km) of new roads for the 500-MW Windplant (Table 2.1a) would constitute a 400% increase in the miles of roads in the KPPA. Windplant roads would be constructed to BLM standards, including provisions for maintaining surface drainage; therefore, road development would not constitute a significant cumulative impact to topography. Construction of the Medicine Bow windfarm would also contribute to altered drainage patterns on approximately 1,344 ac adjacent to the KPPA. Disturbance attributable to the Proposed Action (for the LOP), the coal mines, existing disturbance within the KPPA, and the proposed Medicine Bow windfarm totals 25,096 ac; cumulative impacts to topography would be moderate for the LOP, but negligible after reclamation.

4.1.3 Mineral Resources

4.1.3.1 Significance Criteria

Impacts to mineral resources would be considered significant if access to existing permitted leases is restricted by the proposed project. This criterion is consistent with the mineral management goals specified in the GDRA RMP (BLM 1987:48-57). Moderate or negligible impacts would occur if access to economically recoverable resources is restricted.

4.1.3.2 Proposed Action

Because there are no active coal leases within the KPPA, the Proposed Action would not have a significant impact on coal resources. Recoverable reserves exist within the KPPA, but the potential for future coal mining is low (Section 3.1.3.1). The Windplant would preclude coal mining for the LOP such that if mining becomes economical during the LOP, moderate impacts to coal would occur.

The proposed project probably would not affect existing oil and gas extraction operations within the KPPA, and limited additional oil and gas development would probably not affect or be affected by the proposed project (i.e., impacts would be negligible). Oil and gas leases within the KPPA could be developed if facilities would not interfere with Windplant operation. The Windplant would limit the placement of oil and gas wells, pipelines, and other facilities. Windplant access roads, however, may provide some access to such developments. Future oil and gas development would depend on establishment of cooperative agreements between the Windplant owners, the proposed developers, and landowners. Alternate transmission line routes 1 and 3 each intersect one producing oil or gas field, but well locations would be avoided, and thus, impacts would be negligible for the LOP.

No detrimental impact to existing gravel quarry operations is anticipated from the proposed project. Gravel from quarries within and adjacent to the KPPA may be used for development and maintenance of roads. There are no active uranium leases within the KPPA, and the potential for uranium or other mineral development is low. Therefore, impacts from the Proposed Action on these mineral resources would be negligible.

4.1.3.3 Alternative A

Impacts to coal, oil, gas, and other mineral developments under Alternative A would be negligible and reduced by approximately 40% from those identified for the Proposed Action, since approximately 556 fewer WTGs would be erected. However, the potential for future conflicts between gas and oil recovery and coal mining would remain at a similar level of significance (i.e., moderate) to the Proposed Action.

4.1.3.4 No Action

No impact to mineral resources within the KPPA would occur under the No Action Alternative. However, an alternate energy resource, possibly fossil fuels, would be needed to compensate for the loss of power that would be generated by the Windplant. Under the No Action Alternative, negative impacts to fossil fuels could occur.

Fossil fuel extraction results in a significant, irretrievable loss of nonrenewable resources (BLM 1994d). Power generated by the 500-MW Windplant in one year would be equivalent to the burning of 2,388,100 bbls of oil or 11,320,000 mcf of gas (SMUD 1993). Conserving these reserves has two beneficial impacts. First, these resources would be available for future development to meet growing energy needs. Second, pollutant emissions caused by burning these resources would be delayed (see Section 4.1.1 for air quality impacts).

4.1.3.5 Cumulative Impacts

Cumulative impacts to oil, gas, and coal development would be negligible for the LOP and beyond. Limited oil and gas development would be possible within the KPPA for the LOP. Although coal mining is not anticipated in the near future, it may become economical prior to the cessation of windpower production, at which point, resource development conflicts would occur. Similar conflicts also would occur due to development of the proposed Medicine Bow windfarm. It is not known whether coal mining would become economical during the LOP, and thus, the magnitude of this potential impact cannot be evaluated. If the ROW easement is granted, KENETECH and PacifiCorp would have priority and would be allowed to continue Windplant development. Based on the oil and gas equivalency estimates provided by the SMUD (1993), beneficial impacts on fossil fuels from 500 MW of windpower generation could include the savings of approximately 72 million bbls of oil and 340 mmcf of gas over a 30-year LOP.

4.1.4 Geologic Hazards

4.1.4.1 Significance Criteria

Impacts to geologic hazards would be considered significant if project activities resulted in landslides, subsidence, increased flooding, or reactivation of sand dunes. Impacts to the project from geologic hazards would be significant if project facilities are damaged due to seismic events, landslides, subsidence, or flooding.

4.1.4.2 Proposed Action

Potential impacts to the project from geologic hazards are negligible for the LOP and beyond. Windplant facilities would be located to avoid abandoned underground mines; therefore, damage due to subsidence is unlikely. Alternates 1 and 2 each would cross approximately 1.0 mi (1.6 km) of mined-out areas and Alternate 3 would cross approximately 2.0 mi (3.2 km) of mined-out areas, but no subsidence is known to have occurred in these areas. Mined-out areas would be inspected by a professional geologist or engineer prior to construction in these areas. Earthquake potential is very low, and thus, impacts from earthquakes are negligible. Facilities would be designed and constructed to Zone 4 Unified Building Code (UBC) standards, which would be more than adequate to withstand earthquakes of the magnitude expected to occur in Carbon County. Yellowstone Park is a Zone 4 area, where earthquake intensities would be expected to range from 8.0 to 9.0 on the Modified Mercali Scale; Carbon County is a Zone 1 area, where earthquake intensities would range from 6.0 to 7.0 (personal communication, September 1994, with James Case, WGS).

Areas prone to landslides or flooding would be avoided, wherever feasible; therefore, impacts from these hazards and the potential for increasing these hazards (i.e., causing landslides or flooding) would be negligible. If landslide areas must be disturbed, stringent erosion control and stabilization measures would be implemented throughout construction and O&M to minimize slope movement and reduce public safety risks. Additional Windplant-caused snow accumulation in landslide-prone areas also could cause landslides during spring snowmelt. Facilities would be located to avoid areas directly upwind of landslide areas, where feasible, to minimize snow accumulation on landslide areas (Section 4.1.1.1).

Construction in flood-prone areas will be completed during dry periods (e.g. late summer and fall), and facilities in these areas will be designed to withstand periodic floods. The transmission line would be constructed to span flood-prone areas, where feasible, and thus, there are no differences in impacts to/from flooding among the three alternate routes. None of the proposed routes crosses areas with landslide potential (Map 3.2).

While there are no known sand dunes in the area, removal of ground cover could result in severe erosion of windblown deposits, which could cause substantial soil loss and a decrease in productivity. Areas of windblown deposits would be avoided, where feasible, and all necessary disturbance in these areas would be reclaimed and stabilized as soon as practical, based on consultations with the BLM conducted during the POD process. Only Alternate 3 crosses areas where windblown deposits occur, but structures would be placed to avoid these deposits, where feasible, and thus, impacts to these deposits would be negligible. If any of these areas must be disturbed, stringent erosion control measures would be used and reclamation would occur promptly after construction; therefore, impacts would be negligible for the LOP and beyond.

<u>4.1.4.3 Alternative A</u>

Impacts on project activities from geologic hazards under Alternative A would approximate those for the Proposed Action (i.e., negligible for the LOP). Since Windplant development activities under Alternative A would be reduced by approximately 40% from the Proposed Action, there would be a similar reduction in potential impact levels. Impacts from transmission line construction would be identical to the Proposed Action (i.e., no significant impacts would occur) and there are no differences in impacts among the three alternate routes.

<u>4.1.4.4 No Action</u>

Under the No Action Alternative, no impacts to or from geologic hazards would occur.

<u>4.1.4.5 Cumulative Impacts</u>

There is widespread potential for disturbance of mined-out areas, sand dunes or windblown deposits, landslide areas, and floodplains within and around the KPPA. However, because geologic hazards would be avoided by all development projects wherever feasible, cumulative impacts due to/from geologic hazards would be negligible for the LOP and beyond. If geologic hazard areas on public lands cannot be avoided, detailed site-specific evaluations of potential impacts would be made and stringent stipulations to protect public health and safety, as well as the resource to be affected, would be incorporated into the POD for that phase of development.

4.1.5 Paleontologic Resources

4.1.5.1 Significance Criteria

Impacts to paleontologic resources would be considered significant if important fossils were to be lost or destroyed. Loss or destruction may occur directly during construction, or indirectly due to private collection or vandalism. Beneficial impacts would include discovery of important fossils during predisturbance paleontologic surveys.

4.1.5.2 Proposed Action

The Class I paleontologic survey of Foote Creek Rim will be completed by a BLM-approved paleontologist and included in the FEIS for this project. Based on results of the Class I survey, BLM will determine if a Class III survey of proposed disturbance areas will be required (BLM 1993b). If it is required, the Class III survey results would also be included in the FEIS. Therefore, impacts to paleontolgical resources would be negligible for the LOP and beyond. Important paleontologic resources would either be avoided or recovered prior to construction in the KPPA. Because rock formations within the KPPA are known to contain fossils, monitoring during construction in certain areas may be required by the BLM to prevent accidental destruction of paleontological resources. If important fossils are discovered during construction, surface-disturbing activities at the site would cease until a BLM-approved paleontologist could evaluate the site and appropriate mitigation measures could be implemented.

Indirect impacts to paleontologic resources could occur from the loss of important fossil materials due to private collection or vandalism of newly exposed areas. Employee education about the value of these resources would minimize any indirect impacts. Beneficial impacts could result from the discovery and analysis of paleontologic resources during project implementation. Paleontologic resources discovered during project construction would be evaluated by a qualified paleontologist as deemed appropriate by the BLM, and significant features would be avoided or recovered prior to continuing construction activities.

Disturbance from transmission line construction would be slightly greater along Alternate 3 compared with the other two alternates, and Alternate 3 would pass within 0.25 mi (0.40 km) of a known paleontologic locality. This locality, and any others found during surveying or construction, would be avoided. Because all three alternate routes cross formations rated by the BLM as having significant or important fossil resources (i.e., the Hanna, Ferris, Wind River, and Mesaverde Formations and Miocene rocks) each has similar potential for encountering significant paleontologic resources.

4.1.5.3 Alternative A

Because the same mitigation measures would be used to prevent impacts to paleontologic resources under Alternative A as under the Proposed Action, impacts to these resources would be negligible or beneficial. The level of new ground disturbance under this alternative would also be reduced from approximately 1,787 ac for the Proposed Action to approximately 1,146 ac for Alternative A (Table 4.1), and thus, potential for impacting fossils would be reduced, but opportunities for fossil discovery would also be reduced.

4.1.5.4 No Action

No negative impacts to paleontologic resources would occur under the No Action Alternative. However, the potential for beneficial paleontologic discoveries would be lost.

4.1.5.5 Cumulative Impacts

The combined disturbance of the proposed Windplant and other proposed and existing developments in the region could uncover or destroy important fossils. All new development activities on public lands would be subject to stipulations promulgated in BLM guidelines for paleontologic surveys and evaluations and paleontologist qualifications (BLM 1993b). Adherence to these guidelines would prevent significant impacts to fossils throughout these combined project areas. Existing disturbance from coal mines, oil and gas developments, and roads must be cleared for paleontologic resources through WDEQ permitting, the Application for a Permit to Drill, or a ROW grant application, respectively. Therefore, impacts of past and future mineral developments on paleontologic resources in the cumulative impacts analysis area would be negligible or beneficial.

4.1.6 Soils

4.1.6.1 Significance Criteria

Impacts to soils would be considered significant if project activities resulted in noncompliance with stipulations in the PODs. PODs are developed on a site-specific basis and include provisions for:

- post-development land use;
- erosion control during construction, O&M, and reclamation;
- erosion control success standards; and
- revegetation success standards.

4.1.6.2 Proposed Action

Impacts to soils would be moderate during construction and negligible for the LOP. Phase I of the Proposed Action would impact 319 ac of soil during construction and 68 ac for the LOP (Table 4.1). Initial construction would effect approximately 227 ac of soils on nearly level to moderately steep uplands with 40 ac of disturbance for the LOP after initial reclamation. Soils on nearly level to gentle slopes on terrace remnants would have 88 ac disturbed initially, with 28 ac remaining disturbed after reclamation. Other soil disturbances would impact 3 ac of soils on ridges, sideslopes, and rough broken lands and 1 ac on nearly level to gently sloping alkaline alluvial soils. Soils would be reclaimed immediately after construction. Approximately 194 ac (4%) of the soils to be disturbed on the Foote Creek Rim area have severe wind erosion potential. All areas not utilized by construction or roads would be reclaimed immediately after construction, using approved methods.

The layout of the Simpson Ridge construction phase has not been determined, therefore, the types and amounts of soils that would be impacted remain unknown. Potentially sensitive soils would be avoided when feasible, but due to the widespread occurrence of soils with severe erosion potential, especially in the Simpson Ridge area, not all sensitive soils could be avoided. Sensitive soils are subject to severe wind erosion when vegetative cover is removed. Because winds within the KPPA are strong and persistent, windblown deposits and other unstable soils would only be disturbed if absolutely necessary, and stringent soil stabilization measures would be implemented immediately.

Soils on ridges, sideslopes, and rough broken lands can be subject to accelerated wind and water erosion if disturbed. Additionally, sensitive soils exhibit lower reclamation potential. The actual amount of soil loss and the potential for maintaining long-term productivity depends on site-specific conditions and the effectiveness of proposed mitigation measures.

Moderate construction phase impacts would occur during vegetation stripping, topsoil salvage and temporary stockpiling, cut-and-fill operations, and from increased soil exposure. Soils exposed due to removal of surface cover would be subject to accelerated water and wind erosion until suitable vegetation is restored. Temporary soil compaction could be caused by heavy equipment traffic during the construction phase. Erosion, compaction, and surface crusting due to raindrop impact may result in reduced productivity due to soil loss, damage to soil structure, decreased infiltration, and decreased water storage capacity.

Impacts to soils would be reduced or minimized through timely and rigorous application of erosion control and reclamation measures. Topsoil salvaged from roadways and WTG construction sites would be spread during the initial reclamation process. The increased depth of topsoil on disturbed areas could potentially enhance reclamation and revegetation efforts on disturbed areas and prevent the loss of topsoil productivity due to long-term storage. These efforts would be monitored and repeated, if necessary, until vegetation is reestablished and erosion is minimized. Soils compacted during construction would be adequately ripped and tilled prior to reseeding. With successful reclamation of exposed areas following construction, implementation of erosion control measures for the LOP, and complete reclamation at the end of the project, impacts to soils would be negligible for the LOP and beyond, except on steep slopes where impacts could be moderate.

Snow accumulation caused by Windplant facilities could have beneficial or adverse effects on soils. Beneficial impact would occur where melting drifts enhance soil moisture, and thereby, increase soil productivity. Moderate adverse LOP impacts would occur if soils on slopes become saturated due to melting drifts and slope movements or piping causes accelerated soil erosion. Potential for these impacts would be evaluated during preparation of the POD for each phase, and appropriate mitigation measures would be implemented.

Table 4.4 presents a comparison of disturbance acreage of sensitive soils for each alternate transmission line ROW. In each case, LOP disturbance (after initial reclamation) would be approximately zero. Alternate 3 would disturb approximately 23 to 31 ac more than Alternates 1 and 2 [assuming a disturbance width of 50.0 ft (15.2 m)]. Alternate 2 would initially disturb 6 ac of soils on steep ridges, sideslopes, and rough broken lands compared with 3 ac along the other two alternates; and therefore, is the least desirable alternate for minimizing erosion and maintaining compliance with the BLM restriction prohibiting construction in areas with slopes greater than 25%. Alternates 1 and 2 would affect 6 and 4 ac of alkaline alluvial soils, respectively, compared with the 1 ac affected by Alternate 3. These soils may be difficult to reclaim, and thus, Alternate 3 would have fewer limitations. However, the assumption that 50.0 ft (15.2 m) would be disturbed along the selected ROW is an overestimate; projected disturbance is only 12.0 ft (3.7 m), and therefore, there is little difference among ROWs in terms of impacts to soils, except for the acreage of soils on steep slopes encountered along Alternate 2.

4.1.6.3 Alternative A

Impacts to soils under Alternative A would be moderate during construction and negligible to moderate for the LOP. However, the total area of soils impacted would be reduced to 1,146 ac initially and 431 ac for the LOP (Table 4.1). Because the transmission line would be built if either the Proposed Action or Alternative A is authorized, impacts to soils from transmission line construction would be the same for Alternative A as for the Proposed Action, and the limitations noted for Alternate 2 due to steep slopes would apply.

4.1.6.4 No Action

Under the No Action Alternative, no impact to soils due to Windplant development would occur.

4.1.6.5 Cumulative Impacts

Total soil disturbance resulting from existing activities plus the proposed action within the KPPA would be approximately 2,226 ac (4% of the KPPA) initially and 1,154 ac (2%) for the LOP. The coal mines contribute substantially to the cumulative impacts to soils; approximately 22,598 ac have been or will be disturbed by the mines. The incremental increase in impacts to soils from the Proposed Action would be 8% of the projected total disturbance created by the coal

Table 4.4 Comparison of Acreage of Disturbance for Each Alternate Transmission Line Route.[1]

Soil Group	Alternate 1	Alternate 2	Alternate 3
Soils on nearly level to moderately steep uplands	147	138	175
Soils on nearly level to gentle slopes on terrace remnants	0	0	0
Soils on ridges, sideslopes, and rough broken lands	3	6	3
Nearly level to gently sloping alkaline alluvial soils	6	4	1
Total	156	148	179

[1] All numbers are in ac, and are based on an initial disturbance width of 50.0 ft (15.2 m).

mines. Approximately 1,344 ac of soils would be disturbed due to the proposed Medicine Bow windfarm; cumulative disturbance from development (i.e., mining, Windplants, existing disturbance) would total 25,096 ac over the LOP. Cumulative LOP impacts would be negligible, since it is assumed that the mines will eventually complete reclamation, and adequate mitigation measures will be implemented as stipulated in the EIS and PODs.

4.1.7 Surface Water and Groundwater

4.1.7.1 Significance Criteria

Impacts to surface water and groundwater would be considered significant if:

- surface water quality declined such that existing WDEQ surface water quality classifications (WDEQ 1990) were no longer applicable (e.g., surface water quality of the Medicine Bow River declined from Class II to Class III or below);
- surface water quantities were depleted such that the water rights of downstream users were violated;
- groundwater quality in local stock or domestic wells declined such that the waters would no longer be suitable for current uses;
- groundwater quantities were depleted such that local wells would no longer serve their present functions;
- project activities were conducted in violation of procedures specified in the approved Stormwater Pollution Prevention Plan (SPPP) (to be provided with the POD for each phase); or
- point source or non-point source impacts to surface water or groundwater violated existing state water quality parameters.

4.1.7.2 Proposed Action

Impacts to surface water quality and quantity from the Proposed Action would be negligible for the LOP and beyond. Potential impacts include increased turbidity, salinity, and sedimentation of surface waters due to runoff and erosion from disturbed areas. Accidental spills of petroleum products or other pollutants also could impact surface water quality (Section 4.7). No surface water would be used for the proposed project, and thus, no significant impacts resulting from surface water depletions are anticipated.

Erosion control measures, including diversion terraces, riprap, matting, temporary sediment traps, waterbars, and timely revegetation of disturbed areas would minimize runoff-related sedimentation impacts. Erosion-prone areas (e.g., steep slopes, floodplains, and windblown deposits, and the Second and Third Sand Creek special management area) would be avoided, where feasible. If it is necessary to disturb these areas, construction would occur during late summer, fall, or winter, to avoid high flow periods.

Snow redistribution caused by Windplant facilities could affect the local surface hydrology, but impacts are expected to be negligible. Snow accumulation areas would be sources of substantial spring runoff which could cause channel or gully development, ponding, or increased overland flow. Channel or gully formation could result in increased sedimentation of major streams, but the impact is not expected to be significant. Surface runoff patterns also could be affected if facilities prevent or reduce deposition in natural snow accumulation areas. Snow accumulation areas would be monitored and erosion control and/or stream stabilization measures implemented, if necessary, to minimize surface water quality impacts.

Impacts to surface water quality could occur if disturbance within the Second and Third Sand Creek watershed causes accelerated erosion and sedimentation in the Medicine Bow River. During transmission line construction, disturbance within this watershed would be minimized, and stringent erosion control measures would be implemented to prevent accelerated erosion; therefore, impacts would not be significant. Vehicular traffic would be restricted to the ROW. Highly dissected areas (e.g., gullies, headcuts) would be avoided, where feasible. Alternate 3 intersects this watershed below the confluence of Second and Third Sand Creeks, where the creek is deeply incised in a wide alluvial valley. Alternate 2 traverses the middle of this watershed, crossing both Second and Third Sand Creeks, and is thus, the least desirable route for minimizing impacts in this area. Alternate 1 avoids the watershed, and thus, would have no impact on the area.

The southeastern corner of the Simpson Ridge area lies adjacent to Second Sand Creek and its tributaries, and Windplant facilities in this area may impact this watershed. With the use of strict erosion control measures (e.g., avoiding dissected areas, applying erosion control devices such as netting or soil stabilizers, and prompt revegetation of all disturbed areas) impacts would not be significant.

Proper containment of oil and fuel in storage areas and locating facilities away from drainage areas would minimize potential surface water contamination. Contaminated soil from accidental spills would be cleaned up immediately as required by regulation.

Impacts to groundwater would be negligible for the LOP and beyond. Small amounts of surface and or groundwater would be obtained from local municipalities and transported to the site in water trucks for dust abatement purposes. No other groundwater would be used for the proposed project, and thus, impacts to groundwater quantity would be negligible. Groundwater quality could be affected if accidental spills occur in recharge areas, but such spills would be promptly cleaned up, and thus, the potential for polluting groundwater supplies is very slight. Groundwater quality impacts would be negligible for the LOP and beyond.

4.1.7.3 Alternative A

Because the same mitigation measures would be employed under Alternative A as under the Proposed Action, impacts to surface and groundwater would be negligible for the LOP and beyond. The total acreage of new surface disturbance resulting from Alternative A would be reduced from the 1,787 ac required for the Proposed Action to 1,146 ac (Table 4.1), thereby reducing potential increases in runoff sediment loads.

4.1.7.4 No Action

Under the No Action Alternative, there would be no impact to surface or groundwater from the proposed project.

4.1.7.5 Cumulative Impacts

Since little or no surface water is proposed for use during development of the KPPA, and little or none is being used for other developments in the KPPA, there would be no impact to surface water quantities. Many land uses within the North Platte River basin are causing water quality impairment such that some primary surface water uses are not supported (Gumtow 1994) (Section 3.1.5.1). Within the KPPA, cattle grazing, road maintenance, oil and gas operations, traffic on gravel roads, and off-road vehicle (ORV) use are probably contributing to minor impairment of surface water quality. However, in the Medicine Bow River, the major river bisecting the KPPA, all major surface water uses are supported except the cold water fishery, which is partially supported. Therefore, the cumulative impacts of the multiple land uses occurring within the KPPA are not apparently contributing to significant surface water quality impairment. The proposed Windplant (and the proposed Medicine Bow windfarm) would only minimally, if at all, contribute to water quality impairment (e.g., during road construction wherever streams are crossed, erosion of exposed soils during construction and O&M, road maintenance activities), but these activities are not likely to contribute enough sediments or other pollutants to cause significant cumulative impacts.

The major sources of potential impacts to surface water resources would be increased sedimentation from roads, and possibly, limited amounts of overland flow captured in drainage ditches. Mitigation for the potential discharge of sediment-laden drainage would be the development of a settling/percolation pond for collecting discharged water. Implementation of this mitigation measure would prevent impacts to surface water during the construction of the WTG sites, associated electrical systems, and roadways.

Oil and gas developments within the KPPA produce groundwater as a byproduct of oil and gas production, but there are only 7 active wells within the KPPA; therefore, overall groundwater production is minimal. The Hanna coal mines also have the potential for significantly impacting aquifers for the life-of-mine and beyond. However, the proposed project would not add to groundwater extraction within the KPPA; therefore, no cumulative impact to groundwater quality or quantity is anticipated as a result of the proposed project.

4.1.8 Noise and Odor

4.1.8.1 Significance Criteria

Noise. The Federal Interagency Committee on Noise (FICON) recommends the criteria shown in Table 4.5 for the assessment of noise impacts. These significance criteria are based on the assumption that the probability of an intrusive noise resulting in annoyance is dependent on the existing ambient noise level. The higher the ambient noise level, the smaller the increase in noise level required to generate a significant noise impact. The existing ambient noise levels are such that a project-related noise increase of 5 dBA over ambient levels at sensitive receptors (e.g., local residents, sage grouse leks) would be considered significant.

Odor. Any odors produced by the proposed project would be significant if they caused current land users to vacate the KPPA to avoid exposure to odors.

4.1.8.2 Proposed Action

Noise. Impacts due to increased noise would be negligible for the first phase of development, potentially significant for the 200-MW Foote Creek Rim portion, and negligible for the

Table 4.5 Significance Criteria for Noise Impacts.[1]

Ambient Noise Level Without Project	Significant Impact
<60 dBA	+5.0 dBA or more
60-65 dBA	+3.0 dBA or more
>65 dBA	+1.5 dBA or more

[1] FICON (1992), as applied by Brown-Buntin Associates (1994).

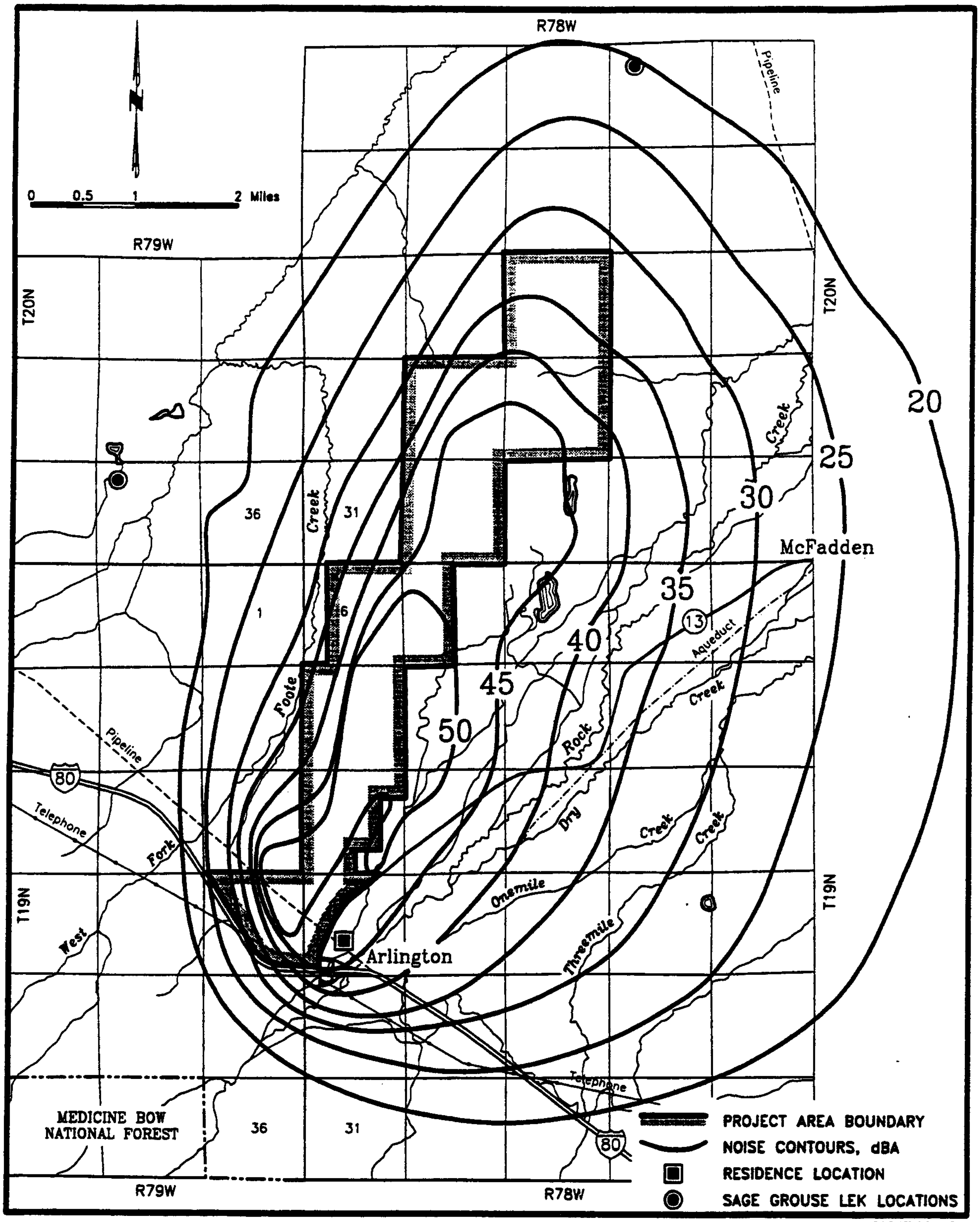
300-MW Simpson Ridge portion of the proposed project. The predominant noise sources associated with the proposed project consist of the WTGs, construction equipment, and the corona effect (the electric discharge at the surface of a conductor or between two conductors) of the high-voltage transmission lines. A combination of noise level measurements, review of existing acoustical literature, and application of accepted noise prediction methodologies was employed to quantify the noise generation of each of these sources.

The Environmental Noise Model (ENM) is a sophisticated noise prediction model capable of generating noise exposure contours of multiple noise sources and various atmospheric and topographic conditions. Data inputs to the ENM include noise source locations, source sound power levels (i.e., dBA), topography, temperature, relative humidity, wind speed and direction, and receiver locations. Each of these variables affects noise levels at receiver locations.

Because atmospheric absorption of sound is generally reduced in cold weather, a temperature of 0 °C was assumed for this analysis to provide a conservative estimate of sound exposure at nearby noise-sensitive locations. From November through March, temperatures average about 0 °C (Table 4.6). A wind speed of 22 mph (10 m/sec) was assumed to represent typical wind speeds on top of Foote Creek Rim. Wind direction is generally out of the west at about 250°. Relative humidity was assumed to average about 35%, which reflects the generally dry conditions in the area. Sensitive receptors identified in the area include the Wyoming Highway Department residences, a KOA campground located near the southern end of Foote Creek Rim, and two sage grouse leks (Map 4.1).

Noise emissions from the 33M-VS turbine have been measured by KENETECH using the American Wind Energy Association *Procedure of Measurement of Acoustic Emissions from Wind Turbine Generator Systems* (1989). Noise levels at the base of a single 33M-VS WTG average 99.3 dBA. A total of 204 WTGs were included in the analysis (three more than would be erected for the first phase of development). Noise impacts from the full 500-MW Windplant are discussed below.

Map 4.2 and Table 4.7 present the predicted noise levels generated by the first phase of development on the Foote Creek Rim area and show that there would be little to no increase in ambient noise levels for the sensitive receptors analyzed. Ambient noise levels at the nearest residences average 59 dBA; predicted levels after project development would average 60 dBA. At the nearby sage grouse lek locations, existing ambient levels and predicted post-development levels are identical (50 to 55 dBA).



Map 4.2 Predicted Noise Levels at Existing Noise-sensitive Areas, Foote Creek Rim Area.

Table 4.6 Estimated Mean Temperature, Foote Creek Rim.

Scale	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
°F	25	30	35	40	50	60	65	65	55	45	35	25	45
°C	-4	-1	2	4	10	16	18	18	13	7	2	-4	7

[1] KENETECH (1994).

The noise predictions are subject to variation due to atmospheric conditions, especially wind speeds. Typical wind speeds for the Foote Creek Rim area were used to make the noise predictions, and thus, these noise levels should also be typical. In the Foote Creek Rim area, therefore, impacts from WTGs would be negligible for the first phase of development. Exact turbine locations for the 200-MW portion on the Foote Creek Rim area and the 500-MW Windplant are not known; therefore, a quantitative analysis of potential noise impacts from future development cannot be made at this time. However, noise produced by the 200-MW Windplant on Foote Creek Rim would probably be 4.6 dBA greater than for the first phase (i.e., each contour on Map 4.1 and the existing plus WTG noise levels in Table 4.7 would increase by approximately 4.6 dBA). Depending on where the additional turbines are placed, nearby residences could experience a 5.6 dBA increase in noise, which would constitute a significant impact. If the additional turbines are placed away from the southernmost sections of the Foote Creek Rim project area, impacts on residents would not be significant. Regardless of turbine placement, sage grouse leks are sufficiently distant from the Foote Creek Rim area such that no significant impacts are expected. Noise impacts on humans from the 500-MW Windplant are also expected to be negligible because there are no occupied residences within the KPPA. Recreational users and landowners utilizing the KPPA would hear the WTGs. Noise impacts on wildlife are addressed in Section 4.2.3.

Noise from construction activities would add to the noise environment in the immediate vicinity of construction. The Proposed Action would generate noise through turbine, road, and distribution, transmission, and communication system construction; potential blasting; traffic; reclamation; and O&M activities. Construction activities would generate maximum noise levels ranging from 85 to 88 dBA at a distance of 50.0 ft (15.2 m) (Table 4.8). Construction activities would be temporary and would occur during normal daytime working hours. Construction noise could result in annoyance if unusually noisy activities occur (i.e., blasting). Noise would also be generated by increased traffic on area roadways. The most important project-generated noise source would be truck traffic associated with transport of heavy materials and equipment.

With standard mitigation measures applied, noise levels at residences and sage grouse leks during Windplant operations would remain within 5 dBA of ambient levels, and thus, impacts would not be significant. Construction within 500.0 ft (152.4 m) of occupied residences would occur only during normal daytime working hours. No surface disturbance would occur on public lands within 0.25 mi (0.40 km) of sage grouse leks, and activities on public lands within 2.0 mi (3.2 km) of leks would be restricted during the nesting period as deemed appropriate by the BLM. Construction would not occur within 0.75 mi (1.21 km) (or other distance as deemed appropriate by the BLM) to active raptor nests during nesting periods or within 0.75 mi (1.21 km) of crucial winter range during critical

Table 4.7 Predicted WTG Noise Levels at Existing Noise-sensitive Areas, Foote Creek Rim Area, Phase I of Development.

	Estimated Existing Ambient Noise Level	Predicted WTG Noise Level	Existing Plus WTG Noise Level
Location	dBA	dBA	dBA
Nearest residences	59	50-55	60
KOA campground	55-60	52	55-60
Sage grouse leks	50-55	27	50-55

[1] Variations in atmospheric conditions, especially wind speed, would affect both ambient and project-generated noise levels.

winter periods. All engines required for project activities would be properly muffled and maintained.

Corona on high-voltage transmission lines produces audible noise. In fair weather, corona noise is typically inaudible to people on the ground. In wet weather, when large numbers of corona sources form as water droplets on conductors, corona noise is audible. Corona noise levels 100 ft (30 m) from a 500-kV transmission line average 20 dBA and 45 dBA in dry and rainy weather, respectively (Lee et al. 1989); therefore, ambient noise levels within the KPPA would generally mask corona noise. Furthermore, no occupied residences occur near any of the proposed alternates. Impacts of corona noise on wildlife are not currently known; Alternate 3 would pass within 0.5 mi (0.8 km) of four sage grouse leks and Alternates 1 and 2 would pass within 0.5 mi (0.8 km) of 5 leks, but the potential noise effects on sage grouse cannot be determined from existing data and are therefore not addressed in this EIS pursuant to 40 C.F.R. 1502.22. Sage grouse use of the KPPA will be monitored to determine possible impacts of Windplant construction and operation on use.

Increased noise levels from the first phase of development (i.e., WTGs and associated facilities, including a 230-kV transmission line) would constitute a negligible, long-term impact. Depending on turbine placement, impacts from the 200-MW Foote Creek Rim portion of the Windplant could be significant. Increased noise levels from the full 500-MW Windplant would be negligible. Increased noise levels due to construction would constitute a short-term, moderate impact. Increased traffic throughout the LOP would constitute a long-term, negligible noise impact.

Odor. The only odors associated with the Windplant would be exhaust odors during construction and O&M. Mitigations would include proper equipment maintenance and use of emission control devices. Impacts associated with odors would be negligible for the LOP.

4.1.8.3 Alternative A

Impacts resulting from noise and odor under Alterative A would be moderate during construction and negligible for the first phase and 300-MW Simpson Ridge portion. Because fewer turbines would be erected, it may be possible to

Table 4.8 Typical Construction Equipment Noise.

Type of Equipment	Maximum Level, dBA at 50.0 ft (15.2 m)
Bulldozer	87
Heavy truck	88
Backhoe	85
Pneumatic tool	85

Cunniff (1977).

locate further development on the Foote Creek Rim area away from nearby residences, thereby avoiding a potentially significant impact. Noise and odor impacts would be reduced by approximately 40%, since fewer WTGs would be erected and commissioned. Noise and odor impact mitigations identified for the Proposed Action would be implemented under Alternative A, and thus, impacts would be moderate during construction and negligible for the LOP.

4.1.8.4 No Action

No additional impact from noise and odor above existing levels on the KPPA would occur under the No Action Alternative.

4.1.8.5 Cumulative Impacts

Noise. Existing land uses within the KPPA (e.g., livestock grazing, oil and gas production, transportation, recreation) contribute to noise levels, but wind is generally the primary noise source. The proposed project would increase the number of noise-producing facilities within the KPPA, which may augment the level of impacts to other resources (e.g., increased acreage of wildlife habitat loss, increased impacts to recreational users) (see Sections 4.2.3 and 4.5.2.5). The addition of the proposed Medicine Bow windfarm would further contribute to increased noise levels. Large turbines (i.e., 500-2000 kW) are proposed for the Medicine Bow project, but exact models have not been identified, and thus, expected noise levels are unknown. If noise is a factor that contributes to big game or avian displacement, cumulative impacts could be significant (Section 4.2.3). Because turbine noise is typically masked by the wind at short distances from WTGs and because there are few occupied residences within or adjacent to the KPPA, cumulative impacts would probably be negligible for the LOP. Sage grouse use within the KPPA would be monitored, and additional mitigations would be developed if changes in sage grouse use patterns are attributed to the Windplant.

Odor. Most odors in the KPPA would be associated with Windplant construction equipment and would be short-term. Odors from O&M vehicles would be negligible for the LOP; therefore, cumulative impacts from odors would be negligible.

4.1.9 Electric and Magnetic Fields

4.1.9.1 Significance Criteria

Significant impacts from EMFs would occur if transmission line operation resulted in direct adverse health effects on humans residing in or using the KPPA. Significant effects on radio and

TV frequencies would occur if Windplant operation resulted in the interruption of permitted TV or radio transmissions.

4.1.9.2 Proposed Action and Alternative A

Because EMF levels generated by the 230-kV transmission line are low, impacts would be negligible for the LOP and beyond for the Proposed Action and Alternative A. Future residential development may be limited due to the transmission line, but this potential impact would be negligible because the area is rural and alternate building sites are numerous.

Turbines with metal rotors are known to interfere with radio and TV transmissions; however, the 33M-VS uses only fiberglass rotors, and thus, no impacts on EMFs would occur under the Proposed Action or Alternative A.

4.1.9.3 No Action and Cumulative Impacts

Under the No Action Alternative, no impacts to/from EMFs would occur. There are only two small segments of other transmission lines within the KPPA, and the proposed Medicine Bow windfarm would probably be connected to an existing WESTERN transmission line. Cumulative impacts to/from EMFs would be negligible for the LOP and beyond.

4.2 BIOLOGICAL RESOURCES

4.2.1 Vegetation

4.2.1.1 Significance Criteria

Impacts to vegetation resulting from the proposed project would be considered significant if:

- an overall change in land use occurs due to changes in vegetation;
- vegetation productivity is not restored to at least predisturbance levels within five years after reclamation;
- species composition or diversity change by greater than 20%, due to unsuccessful reclamation of disturbed areas or snow redistribution; and/or
- uncontrolled weed invasion of project area or adjacent areas occurs.

These criteria do not have a regulatory or scientific precedence, but have been used in recent EISs (BLM 1994d) by the GDRA and the Rawlins District Office.

4.2.1.2 Proposed Action

Impacts to vegetation would be potentially significant to negligible for the LOP and beyond. Potentially significant impacts would occur due to localized changes in plant community species composition due to changes in snow deposition patterns caused by Windplant facilities. Vegetation removal, temporary changes in vegetation types (e.g., shrubland to grassland conversions during reclamation), weed infestations, and the potential for accelerated erosion constitute both short-term and LOP impacts. Mitigation measures to limit vegetation impacts include minimizing the extent of disturbance, using appropriate erosion and sedimentation controls, using weed control practices as deemed appropriate by the BLM, and implementing prompt revegetation using an appropriate locally adapted seed mixture. With the application of these mitigation measures, impacts to vegetation resulting from the Proposed Action due to disturbance are anticipated to be negligible for the LOP unless reclamation is unsuccessful after five years. Because only 3% of the KPPA would be disturbed by Windplant development, impacts to vegetation would not create an overall land use change (Section 4.5).

The acreage of vegetation types that would be disturbed by Phase I of the project was determined from the facilities location map (Map 2.1). The Phase I, 70.5-MW development would affect 319 ac (Table 4.9). Grassland and meadow/riparian vegetation community types would be most heavily impacted, with 14% (2 ac) and 13% (4 ac) of the total acreage of these types in the KPPA being disturbed, respectively (see Section 4.2.2 for a

Table 4.9 Vegetation Disturbance Acreage, Phase I and the 500-MW Windplant.

	Phase I 70.5 MW				Full Windplant 500 MW[1]			
Type	New	% of Type[2]	LOP	% of Type[2]	New	% of Type[2]	LOP	% of Type[2]
Mixed grass/sagebrush shrubland	45	1	16	<1	188	6	82	3
Cushion plant/grassland	105	8	49	4	168	13	76	6
Mountain shrubland	4	<1	0	0	195	3	84	1
Aspen woodland	0	0	0	0	7	5	3	2
Ponderosa pine woodland	0	0	0	0	1	4	1	4
Meadow/riparian areas	4	13	1	3	6	19	2	6
Grassland	2	14	2	14	4	29	2	14
Sagebrush shrubland	147	<1	0	0	1034	3	389	1
Saltbush shrubland	6	<1	0	0	79	2	33	1
Barren or near-barren areas	4	<1	0	0	65	2	27	1
Greasewood shrubland	2	<1	0	0	40	3	16	1
Total	319	--	68	--	1,787	--	715	--

1 Because the exact locations of future phases are unknown, vegetation disturbance for the full 500-MW Windplant was assumed to be proportional to the acreage of types currently existing in the Foote Creek Rim and Simpson Ridge areas plus the Alternate 3 ROW (see text).

2 Percentage of type is based on total acreage of each type in the Foote Creek Rim and Simpson Ridge areas plus the Alternate 3 ROW as given in Table 3.9.

discussion of wetlands impacts). Approximately 147 ac of sagebrush shrubland and 105 ac of cushion plant/grassland types would be disturbed, which amounts to <1% and 8% of the total acreage of these types within the KPPA.

Because the exact locations of disturbance for phases subsequent to Phase I are unknown, vegetation disturbance for these areas was estimated by multiplying the proportions of vegetation types in the Foote Creek Rim and Simpson Ridge areas, respectively (Table 3.9), by the expected LOP disturbance (1,787 ac). These estimates were added to disturbance acreages (by vegetation type) for Phase I. Of the 1,787 ac of initial disturbance for the 500-MW Windplant, most disturbance would occur in sagebrush shrubland (1,034 ac). However, this represents only 3% of the total acreage occupied by this type. Grasslands (29%) would be most affected. Meadow/riparian vegetation community types also could be substantially affected (19% of the total acreage for this type within the KPPA), but these areas would be avoided, where feasible. Total LOP disturbance would impact 389 ac (1%) of sagebrush shrubland and 1 to 84 ac (1-14%) of other vegetation types.

Redistribution of snow caused by the Windplant could alter vegetation patterns within the KPPA. Spring snowmelt in snow accumulation areas would increase the effective precipitation in soils, which would favor plant species that require more mesic habitats. Conversely, a reduction in drifting in natural snow accumulation areas would shift species composition towards species favoring xeric habitats. Shifts in species composition may be significant in localized areas, but the overall mosaic within the KPPA probably would not change by greater than 50% because of the overriding influence of climate and soils on plant communities; therefore, areawide impacts are not expected to be significant.

Areas scheduled for reclamation would be seeded with a BLM-approved mixture of plant species in the fall prior to ground freeze-up, or in the spring prior to April 15 if fall seeding is not feasible. Reclamation procedures would comply with the BLM's *Wyoming Policy on Reclamation* (BLM 1990b). Potential plant species for use in reclamation are discussed in Section 5.1.3.10. Appropriate erosion control techniques (e.g., waterbars, mulch, etc.) would be employed as needed.

Revegetation may, during some years or at some locations, be inhibited by droughts and/or soil limitations. Windplant owners and/or KENETECH personnel, under BLM supervision, would be responsible for monitoring reclamation success. In addition, site-specific conditions at each proposed development site would be evaluated during the POD preparation, and appropriate measures such as ripping, pitting, windrowing, mulching, and/or reseeding with BLM-approved alternative non-native species would be employed. Increases in abundance of weedy species would be mitigated promptly using BLM-, county-, and landowner-approved control methods. The primary procedure for preventing weed infestation would be prompt revegetation of disturbed areas with locally adapted desirable plant species. If weed control is necessary, mechanical means (e.g., harrowing, discing) may be used. If chemical control is necessary, prior approval would be obtained from the BLM, the county, or landowners, and only chemicals approved for the specific application would be used.

4.2.1.3 Alternative A

Under Alternative A, approximately 40% less vegetation would be disturbed than under the Proposed Action (1,146 ac initially and 431 ac for the LOP) (Table 4.1). Because mitigation and reclamation measures would be implemented as described for the Proposed Action, these disturbance-caused impacts to vegetation would be negligible for the LOP. Impacts to vegetation patterns due to snow redistribution also would be reduced by approximately 40%, but the impact would be potentially significant due to localized changes in plant species composition.

4.2.1.4 No Action

No increased impacts beyond existing levels would occur to vegetation under the No Action Alternative, since no additional disturbance would occur.

4.2.1.5 Cumulative Impacts

Existing and proposed disturbance in the KPPA would total 2,226 ac (4% of the KPPA) initially and 1,154 ac (2%) for the LOP (Table 4.1). The coal mines also contribute to substantial vegetation disturbance in the region (22,598 ac total or approximately 5,741 ac in any one year). The proposed Medicine Bow windfarm would disturb an additional 1,344 ac. The primary measures for reducing cumulative impacts would be successful revegetation with adapted, native and introduced plant species and avoidance of meadow/riparian areas, where feasible. It is assumed that successful revegetation would be accomplished, and therefore, post-development land use, productivity, plant species diversity, ground cover, wildlife habitat, and weed control goals would be achieved, and long-term cumulative impacts would be negligible. However, there would be an overall shift in the character of vegetation from shrublands to grasslands because of the time needed to establish shrubs in this low precipitation environment (15 to 20 years), and this would be considered a moderate long-term impact.

4.2.2 Wetlands and Riparian Areas

4.2.2.1 Significance Criteria

Impacts to wetlands and riparian areas would be considered significant if project activities resulted in violation of Section 404 of the Clean Water Act or Executive Order 11990. Section 404 governs the placement of dredged or fill material in waters of the U.S., and Executive Order 11990 mandates no net loss of wetlands.

4.2.2.2 Proposed Action

Where feasible, no surface disturbance would occur within 500 ft (152 m) of wetlands or open water, or within 100 ft (31 m) of ephemeral or intermittent channels; and since there would be no net loss of wetlands, impacts to wetlands would be negligible. Wetlands and riparian areas that rely on snow accumulation to preserve wetland and riparian characteristics would be impacted if Windplant facilities reduce or prevent snow accumulation in these areas. In snow deposition areas, wetlands or riparian areas may be enhanced by the Windplant. Potential effects of snow redistribution on wetlands and riparian areas would be evaluated during POD preparation and the Section 404 permitting process. Impacts to wetlands and riparian areas would be mitigated by locating facilities to avoid impacting these areas and/or through other measures specified in the SPPP.

There are no wetlands on top of Foote Creek Rim that would be impacted by Phase I of the proposed project. The primary access road, however, would cross areas potentially containing wetlands. Formal wetland delineations of these areas would be conducted during the spring of 1995, and all permits necessary to comply with the above-referenced laws would be obtained prior to road construction.

Best management practices would be used during construction in all wetland/riparian areas, including, but not limited to: construction during periods of low or no water; following existing ROWs and using existing crossings; and creating temporary diversions using temporary channel stabilization techniques (e.g., riprap), where feasible.

If disturbance to wetland or riparian areas is unavoidable, appropriate mitigation measures would be developed in coordination with the COE and BLM biologists. If rehabilitation of a wetland area is required, the initial primary objective would be soil stabilization with native species. The desired plant species composition after rehabilitation would depend on site-specific objectives.

4.2.2.3 Alternative A

Since there would be no net loss of wetlands and project activities would comply with Section 404 of the Clean Water Act, impacts to wetlands and riparian areas under Alternative A would be negligible.

4.2.2.4 No Action

There would be no impacts to wetlands or riparian areas from the proposed project under the No Action Alternative, since no further development of the KPPA would occur.

4.2.2.5 Cumulative Impacts

Cumulative impacts to wetlands and riparian areas would be negligible because most past and all present and future development activities would comply with Section 404 of the Clean Water Act and Executive Order 11990. Effects of snow distribution on wetlands would be monitored, if required by the BLM or the COE during the Section 404 permitting process, and mitigations would be developed for any wetlands lost, if necessary. The coal mines are typically required by WDEQ to replace wetlands and riparian areas at least ac-for-ac and in kind. Avoidance and mitigation measures would be applied to all present and future developments.

4.2.3 Wildlife and Fisheries

Information pertaining to the impact of large-scale Windplants on wildlife is limited; some research has been done pertaining to collision mortality and raptors in California (see Section 4.2.3.4 for details). The direct impact of habitat loss resulting from construction of the Windplant and associated ancillary facilities is quantifiable, and the significance of this loss to various wildlife resources within the KPPA can be estimated. On the other hand, to quantify the effects of such influences as noise, visual disturbance, human activity, and changes in snow distribution on wildlife behavior and habitat use is difficult. An extensive search of the literature pertaining to impacts on wildlife resources from oil and gas development, surface mining, roads, fences, human activity and other sources of disturbance provided the means to describe a range of potential effects to wildlife due to the proposed Windplant.

4.2.3.1 Big Game

Significance Criteria. For this EIS, impacts to big game would be considered significant if project-related activities resulted in a loss of greater than 1% of the existing crucial big game range for a particular herd unit (Environmental Research and Technology, Inc. 1983a, 1983b). The rationale for this criterion is provided below.

There is a lack of definitive research regarding the level of disturbance within big game crucial habitat (i.e., crucial range) that constitutes a significant impact to big game populations. As a result, regulatory agencies operate under slightly different guidelines pertaining to the amount and type of disturbance allowed within big game crucial range. In the opinion of the WGFD, all crucial big game habitat is vital to sustain communities, populations, or subpopulations of big game animals (WGFD 1994c). As part of their mitigation policy, the WGFD is directed by the Wyoming Game and Fish Commission "to *recommend* no loss of habitat function within crucial habitat" (WGFD 1994c). Habitat function is defined as "the arrangement of habitat features, and the capability of those features, to sustain species, populations, and diversity of wildlife over time" (WGFD 1994c). Although some modification of habitat characteristics may occur due to proposed developments, the habitat function of crucial range must be maintained (i.e., the location, essential features, and species supported must remain unchanged).

The amount of crucial habitat removed within a given herd unit by development activities is a quantifiable measurement of impacts to habitat function. The BLM has determined that project-related disturbance of up to 1% of the crucial range of a big game herd unit is unlikely to significantly impact the habitat function of such range, and has incorporated this standard into recent EISs for proposed projects within Wyoming (BLM 1992a, 1994d). Displacement of big game from areas adjacent to the Windplant and associated facilities due to visual and noise characteristics of the proposed project may also impact habitat function; the potential extent of this impact, based on published research, is described below on a species-specific basis. The response of big game populations to Windplant presence and operation will be monitored beginning with Phase I construction to determine the extent of disturbance to these populations, and to assess the potential impacts to big game associated with the construction and operation of the 500-MW Windplant. If it is determined from this initial monitoring that the proposed project would present a potentially significant impact to big game, BLM would initiate site-specific, detailed analyses for the affected species to definitely evaluate impacts.

Proposed Action. All four big game species commonly occurring within the KPPA (i.e., pronghorn, mule deer, white-tailed deer, and elk), would experience, at a minimum, some disturbance due to habitat loss and displacement from construction and O&M activities of the proposed Phase I and 500-MW Windplant. The acreages presented below are for the amount of habitat actually disturbed; additional habitat adjacent to the actual disturbance may not be used by big game due to the presence of humans and equipment during construction and O&M activities.

Impacts to pronghorn habitat due to Phase I activities would be negligible during construction and throughout the LOP. Approximately 54 ac of pronghorn crucial winter/yearlong range would be disturbed within the Medicine Bow Herd Unit due to Phase I construction; this represents 0.02% of this range type within the herd unit (Table 4.10). Since all of this disturbance within crucial range is the result of the construction of the 230-kV transmission line, virtually no disturbance would remain once the area around the poles is fully reclaimed (i.e., LOP). The only other pronghorn range type that would be disturbed by construction and operation of Phase I is winter/yearlong range. Approximately 265 ac of this range would be initially disturbed by Phase I activities; this represents a negligible loss of about 0.04% of this range within the Medicine Bow Herd Unit. The disturbed area would decrease to 68 ac (0.01%) following reclamation (i.e., LOP).

Initial pronghorn habitat loss due to construction of the 500-MW Windplant would result in a moderate impact to the Medicine Bow Herd, and this impact would likely remain moderate for the LOP. Construction of the 500-MW Windplant would result in an initial loss of 140 ac of crucial winter/yearlong range for the Medicine Bow Pronghorn Herd, or 0.06% of this range type within the herd unit (Table 4.10). This is a small percentage of available crucial habitat and well below the significance criterion of 1% loss of crucial habitat stated above. Some habitat loss within pronghorn crucial range (i.e., 38 ac, or 0.02%) would remain during the LOP; loss could be reduced to zero if WTGs are located outside of this range type. The greatest habitat loss for pronghorn would be within winter/yearlong range: 1,262 ac would be disturbed initially (i.e., 0.21% of this range type within the herd unit), and 509 ac (0.08%) would remain unavailable for pronghorn use for LOP. This winter/yearlong habitat loss would likely be a moderate impact to the herd. Some acreage would also be lost within spring-summer-fall range [i.e., 385 ac (0.14%) initially and 168 ac (0.06%) LOP].

The overall response of pronghorn to the fully operating 500-MW Windplant is difficult to predict. Yeo et al. (1984), studied pronghorn response to two large WTGs immediately north of the KPPA and determined that pronghorn were not displaced from their home ranges due to the presence of the WTGs. Pronghorn also quickly adapted to the increase in traffic associated with the construction and operation of the WTGs, although roads did influence the distribution of pronghorn during the hunting season. Yeo et al.

Table 4.10 Potential Initial and LOP Disturbances Within Regional Wildlife Habitats for Proposed Action and Alternative A.

Wildlife Resource	Acreage of Wildlife Habitat Within the Region	Proposed Action								Alternative A			
		70.5 MW Phase I				500-MW Windplant				300-MW Windplant			
		Acreage of Disturbance Within Wildlife Habitat		Percentage of Wildlife Habitat Disturbed		Acreage of Disturbance Within Wildlife Habitat		Percentage of Wildlife Habitat Disturbed		Acreage of Disturbance Within Wildlife Habitat		Percentage of Wildlife Habitat Disturbed	
		New[1]	LOP[2]	New[3]	LOP[4]	New[1]	LOP[2]	New[3]	LOP[4]	New[1]	LOP[2]	New[3]	LOP[4]
Pronghorn antelope													
Medicine Bow Herd													
Crucial winter/yearlong range	227,584[5]	54	0	<0.1	0	140	38	<0.1	<0.1	106	23	<0.1	<0.1
Spring-summer-fall range	278,976[6]	0	0	0	0	385	168	0.1	<0.1	232	101	<0.1	<0.1
Winter/yearlong range	605,760[7]	265	68	<0.1	<0.1	1,262	509	0.2	<0.1	808	307	0.1	<0.1
Mule deer													
Platte Valley Herd													
Winter/yearlong range	754,368[7]	0	0	0	0	164	72	<0.1	<0.1	99	44	<0.1	<0.1
Yearlong range	203,136[8]	0	0	0	0	234	102	0.1	<0.1	141	62	<0.1	<0.1
Sheep Mountain Herd													
Crucial winter/yearlong range	158,080[5]	42	0	<0.1	0	42	0	<0.1	0	42	0	<0.1	0
Winter/yearlong range	696,960[7]	275	68	<0.1	<0.1	1,345	541	0.2	<0.1	862	325	0.1	<0.1
Shirley Mountain Herd													
Yearlong range	459,840[8]	2	0	<0.1	0	2	0	<0.1	0	2	0	<0.1	0
White-tailed deer													
Laramie River Herd													
Winter/yearlong range	161,856[7]	4	2	<0.1	<0.1	11	5	<0.1	<0.1	7	3	<0.1	<0.1
Yearlong range	481,984[8]	15	0	<0.1	0	15	0	<0.1	0	15	0	<0.1	0
Elk													
Snowy Range Herd													
Winter/yearlong range	219,520[7]	318	68	0.1	<0.1	1,365	531	0.6	0.2	890	319	0.4	0.1
Sage Grouse													
Probable nesting habitat	300,000[9]	110	2	<0.1	<0.1	1,185	471	0.4	0.2	754	282	0.3	0.1
Potential breeding habitat[10]	9,425[9]	0	0	0	0	0	0	0	0	0	0	0	0

Table 4.10 (Continued)

1 New disturbance acreages are based on percentages of totals from Table 2.1(a); multiply number of ac by 0.4047 to compute number of hectares.

2 LOP disturbance acreages are based on percentages of totals from Table 2.1(a).

3 Percentage of new disturbance = $\frac{\text{total new disturbance within wildlife habitat}}{\text{total acreage of wildlife habitat within the region}} \times 100$

4 Percentage of LOP disturbance = $\frac{\text{total LOP disturbance within wildlife habitat}}{\text{total acreage of wildlife habitat within the region}} \times 100$

5 Total acreage of crucial winter/yearlong range for herd (WGFD 1994a).

6 Total acreage of spring-summer-fall range for herd (WGFD 1994a).

7 Total acreage of winter/yearlong range for herd (WGFD 1994a).

8 Total acreage of yearlong range for herd (WGFD 1994a).

9 Adapted from Medicine Bow-Divide Resource Area RMP data (BLM 1987:200) for the Shirley Mountain Habitat Management Plan (HMP) area and the proposed Saratoga Valley HMP area.

10 Potential sage grouse breeding habitat would be avoided.

(1984) also noted that the proliferation of access roads associated with the WTG development promoted increased harvest.

Pronghorn have exhibited a variety of responses to disturbance related to other types of energy development. In central Wyoming, pronghorn tended to avoid oil fields in which drilling and well maintenance activities occurred (Easterly et al., n.d.). Some animals, however, habituated to human activity associated with petroleum exploration and production, and remained near oil fields during and after drilling operations. A portion of a pronghorn population in the Red Desert of Wyoming habituated to activities associated with a uranium mining project and were observed to migrate around, under, and over man-made structures used in mining operations (Deblinger 1988). Pronghorn does and fawns were commonly observed near the mine pit; they were also observed near oil and gas wells and roads in the area. Other individuals avoided the mine site and migrated around the area without difficulty. Segerstrom (1982) noted that pronghorn near an operational coal mine in Montana habituated to many types of human activity associated with the mining operation; pronghorn generally responded to disturbing situations by slowly moving away from the source of disturbance. The mean intensity of pronghorn reactions to human activity on the mine site was significantly less than the intensity of reactions on a control site.

It is likely that some proportion of pronghorn within the Medicine Bow Herd will habituate to the presence of operating WTGs, as well as to the increased traffic associated with WTG maintenance. Reeve (1984) observed that pronghorn at the large WTG north of the KPPA habituated to construction traffic (i.e., 100+ vehicles/24 hrs) and did not abandon the site. Easterly et al. (n.d.) also noted that pronghorn within sight of an access road did not run in response to traffic going to and from the well pad unless vehicles moved slowly or stopped. To avoid disturbing pronghorn adjacent to Windplant roads, KENETECH personnel would be instructed not to stop their vehicles between service stops unless absolutely necessary. Some pronghorn probably would not habituate to the presence of the Windplant and its associated activities. These animals would likely stay some distance from WTG strings and access roads; it is unknown if this displacement would adversely effect the behavior and fitness of these pronghorn. Monitoring of pronghorn populations, as well as those of other big game species, during Phase I construction and operation will provide insight into the responses and level of habituation of big game to Windplant presence and O&M activities.

Overall, impacts to pronghorn within the KPPA resulting from the construction of the Windplant would range from negligible (Phase I) to moderate (500-MW Windplant); these impacts would remain negligible (Phase I) to moderate (500-MW Windplant) for the LOP. Based on the pronghorn studies discussed above, it is likely that a portion of the pronghorn population within the KPPA will habituate to the operating Windplant and associated O&M activities and will continue to use habitat adjacent to WTGs. Impacts to pronghorn from the noise and movement associated with WTGs, as well as increased human presence, will probably be moderate throughout the LOP (i.e., will not adversely effect population health).

Impacts to mule deer herds within the KPPA would be negligible during construction and operation of Phase I. Only the Sheep Mountain Herd would experience more than 2 ac of habitat loss due to Phase I construction activities (Table 4.10). Forty-two ac of crucial winter/yearlong range would be initially disturbed during Phase I, which represents approximately 0.03% of this habitat type within the Sheep Mountain Herd Unit (i.e., a negligible impact). With successful reclamation, disturbance within mule deer crucial habitat would decrease to zero for the LOP. Habitat loss within other range types for the Sheep Mountain Herd would be negligible for Phase I. Approximately 275 ac of winter/yearlong range within the Sheep Mountain Herd would be disturbed during Phase I construction (i.e., 0.04% of this range within the herd unit), but this would decrease to 68 ac (0.01%) during the LOP. Mule deer habitat loss within the Shirley Mountain Herd would be negligible; 2 ac within yearlong range would initially be disturbed. No mule deer habitat would be lost within the Platte Valley Herd due to Phase I construction or operation.

Mule deer crucial winter/yearlong range loss due to 500-MW Windplant construction and operation would remain at the same level of significance as that due to Phase I (i.e., a negligible impact) (Table 4.10); the same transmission line is required for both situations, and this is the only location where mule deer crucial range occurs within the KPPA. The greatest loss of mule deer habitat due to construction of the 500-MW Windplant would occur within Sheep Mountain winter/yearlong range, with an initial disturbance of 1,345 ac (0.19% of this range type for the herd unit); this represents a moderate impact to the herd. Five hundred forty-one ac (0.08%) would remain unavailable to mule deer within this range type for the LOP. Potential impacts within the Platte Valley Mule Deer Herd would range from negligible to moderate; 234 ac of yearlong range (i.e., 0.12% of this range type within the herd unit) and 164 ac (i.e., 0.02%) of winter/yearlong range would initially be disturbed by the full project. Habitat disturbance in the Shirley Mountain Herd would remain negligible under the 500-MW Windplant (i.e., 2 ac of initial disturbance).

It is possible that mule deer within the KPPA will adapt to Windplant presence and operation. Mule deer frequented areas in and near oil fields in central Wyoming, and appeared to be less sensitive to human-caused disturbances than pronghorn (Easterly et al. n.d.). Irby et al. (1988) noted that low-level oil and gas development in western Montana had little effect on wintering mule deer; high-intensity exploration and production activity, however, could impact populations by making wintering areas unsuitable for mule deer. Mule deer continued to occupy areas immediately adjacent to an operating coal mine in Wyoming (Reed 1981). Mule deer also apparently habituate to the auditory and visual stimuli associated with access roads, and have been observed using areas adjacent to these roads (Reed 1981, Easterly et al. n.d.). Monitoring of mule deer response to WTG presence and activity during Phase I will help determine if mule deer habituate to Windplant development.

In summary, impacts to mule deer within the KPPA from construction of the proposed Windplant would range from negligible (Phase I) to moderate (500-MW Windplant); these impacts would remain negligible (Phase I) or moderate (500-MW Windplant) for the LOP. Mule deer will probably habituate, at least to some extent, to the noise and activity associated with the operating Windplant, and will likely continue to use habitat adjacent to WTGs. Unless Phase I monitoring of mule deer populations reveals otherwise, it is anticipated that impacts to mule deer from the 500-MW Windplant O&M activities will be moderate throughout the LOP.

The Laramie River Herd of white-tailed deer would experience minimal habitat loss due to Phase I and 500-MW Windplant activities (Table 4.10). Fifteen ac (<0.01%) of yearlong range would initially be disturbed by construction of the 230-kV transmission line, but this disturbance would virtually disappear for the LOP. Four ac (<0.01%) of winter/yearlong white-tailed deer range would be potentially disturbed by Phase I construction of the Windplant; current proposed placement of the turbine strings on the Foote Creek Rim area would reduce this habitat disturbance to zero. Slightly more winter/yearlong range may be disturbed due to construction of the 500-MW Windplant [i.e., 11 ac (<0.01%) initially and 5 ac (<0.01%) LOP]. Disturbance within yearlong range as a result of construction of the 500-MW Windplant would remain the same as that for Phase I; there would be no new disturbance for the 500-MW Windplant if the transmission line were constructed during Phase I.

Overall impacts to white-tailed deer due to construction of Phase I and the 500-MW Windplant would likely be negligible. Deer would probably move away from construction activity associated with transmission line placement, but this disturbance would be short-term and limited in extent. Since few, if any, WTGs would occur within potential white-tailed deer habitat, operation of the Windplant would result in minimal disturbance to this species.

Impacts to elk habitat within the KPPA would be moderate during Phase I. However, impacts to elk range may become significant given the extent of habitat disturbance and potential displacement associated with the 500-MW Windplant. Approximately 318 ac of winter/yearlong range within the Snowy Range Elk Herd would be disturbed during Phase I construction; this represents 0.14% of this range type for the herd unit (Table 4.10). Phase I disturbance within winter/yearlong range would decrease to 68 ac (0.03%) following successful reclamation. The 500-MW Windplant would disturb 1,365 ac of winter/yearlong elk range, or 0.62% of this range type within the KPPA; 531 ac (i.e., 0.24%) would remain unavailable to elk during the LOP.

The construction and operation of the 500-MW Windplant may also significantly impact elk within the KPPA by displacing them from an area larger than that directly disturbed by project structures. In western Wyoming, elk have abandoned ranges in which oil and gas drilling and production activities have occurred (Johnson and Lockman 1980, Johnson and Wollrab n.d.). Elk returned to many of these ranges following the completion of drilling activity, but the pattern of elk use has remained unpredictable. Hayden-Wing Associates (1990) noted that elk in western Wyoming moved away from areas where oil field construction and drilling activities were occurring, but moved back again once intensive disturbance ceased. Some elk were observed using areas close to producing wells, but the density of elk remained lower near wells than in areas farther from production activities. In studies of elk response to seismograph exploration, visual (e.g., vehicles, personnel) and audible (e.g., vehicle noise, detonations) disturbances associated with this activity significantly affected elk movements, but not the distribution and range use of elk (Ward 1986, Gillin 1989). Elk tended to move quickly away from human activity and detonations, but returned to these areas within a day or two following disturbance. Simulated surface mine activities (e.g., recorded noise and human activity) in Idaho temporarily displaced elk, but had no effect on overall population fitness (Kuck et al. 1985). These researchers also determined that direct human harassment (i.e., human approach) elicited a greater flight response in elk than did other disturbance types. Although elk within the KPPA may habituate somewhat to the presence of operating WTGs, it is likely that vehicles and personnel traveling between and located at WTG sites would continue to displace elk. This type of "passive" disturbance (i.e., the mere presence of humans within an animal's home range) resulted in the extensive use and overgrazing of marginal areas of potentially available elk range in western Alberta (Morgantini and Hudson 1979).

In summary, impacts to elk within the KPPA from construction and operation of the proposed 500-MW Windplant could be significant. Although elk crucial range will not be disturbed by the proposed project, displacement and disruption of elk movement on winter/yearlong range by O&M activities could increase elk grazing pressure on unaffected range further from WTG locations. Monitoring of elk populations (and their response to O&M activities) during Phase I will clarify the level of potential impacts to elk within the KPPA resulting from development of the 500-MW Windplant.

Winter or winter/yearlong crucial range is very important to pronghorn (Guenzel 1986), mule deer (Mackie and Pac 1980, Carpenter and Wallmo 1981, Olson 1992), and elk (Adams 1982) populations in that it provides relief and survival opportunities during periods of adverse weather. For all three of these species, snow depth and condition is the primary factor governing use of crucial range (Gilbert et al. 1975, Bruns 1977, Yoakum 1978, Carpenter and Wallmo 1981, Adams 1982, Nelson and Leege 1982, Rudd 1982, Skovlin 1982, Guenzel 1986, Oedekoven and

Lindzey 1987). The energy costs of locomotion for a particular big game species are dramatically elevated in snow depths above front knee height (Parker et al. 1984). Melt-freeze and wind crusts that form on the surface of accumulated snow can prevent access to underlying vegetation (Carpenter and Wallmo 1981). It is likely that snow accumulation patterns on the KPPA would change as a result of WTGs and downtower structures, although the extent of these changes is not known (Tabler and Associates 1994). Since few, if any, WTGs or associated structures would be located within big game crucial range on the KPPA, impacts due to changes in snow accumulation would likely be negligible for this range type. However, big game moving through other winter or yearlong range types containing WTGs and associated structures may encounter areas of drifted snow that could impede movement. These drifts would probably not be extensive, and big game could move around them with relative ease. Large-scale habitat changes may occur (over many years) due to increased soil moisture from Windplant-induced snowdrifts; the extent and overall effect of these changes on big game distribution is presently unknown. Phase I monitoring will likely provide some trend information that may allow for reasonable predictions of long-term habitat changes.

In order to minimize potential impacts to crucial big game range within the KPPA, WTG placement would, if economically feasible, avoid these habitats. Transmission line and potential WTG construction and installation activities within crucial range would be scheduled during the period from May 1 through November 14 on public lands to prevent disturbance of wintering animals. Exceptions that allow these activities on public land crucial winter ranges may be granted by the AO if mild winter conditions prevail and ample foraging habitat remains for pronghorn and mule deer on adjacent areas.

The use of fencing within the Windplant would be very limited; chain-link fences would be used to prevent big game, livestock, and people from entering the Windplant substations. Since individual WTGs and WTG strings would not be fenced, it is anticipated that big game movement through the Windplant would not be curtailed or hindered. I-80, located immediately south of the KPPA, acts as an existing barrier to big game movement, especially elk (Ward 1973). Although elk may occasionally feed near I-80, few individuals actually cross the highway due to game fences and heavy traffic (Ward et al. 1973). The traditional migratory movement of elk between winter range (located north of I-80, for the most part) and summer range (located south of I-80) has been permanently disrupted due to the presence of the I-80; in essence, two separate populations of elk exist in the area, one north and the other south of I-80. It is likely that foraging movements of other big game species (i.e., pronghorn, mule deer, and white-tailed deer) have also, at least to some extent, been curtailed.

A slight increase in big game harvest (both legal and illegal) may occur due to increased access through new road development associated with the proposed Windplant. However, access is controlled on private land by landowners, and this would continue to be the case following Windplant construction. KENETECH has committed to educating employees regarding WGFD rules and regulations for the area, and project personnel would support WGFD surveillance in the area by immediately reporting all observed illegal harvesting of wildlife or other mortality of important wildlife on the KPPA.

Since noise associated with WTG operation within the KPPA would only occasionally exceed the ambient background noise (see Section 4.1.8.2), it is likely that the overall effect of WTG noise on big game would not represent a significant impact. Animals (including big game) generally respond to an unusual sound by fleeing the source of the sound; subsequent behavior toward that sound, however, depends on experiences associated with the sound (Geist 1978). If the sound persists and remains localized, and animals can approach or withdraw from the source of their own volition (as with WTGs), animals will likely, over time, ignore the sound. Noise associated with project vehicles and O&M activities may be more disturbing to big game within the KPPA due to its irregular and unpredictable nature. Big game, especially elk, may respond to this type of noise by moving some distance from the source and returning only when the source has left the area. Monitoring during Phase I will provide insight into the extent of disturbance to big game from WTG and vehicle noise.

Alternative A. Big game habitat disturbance associated with construction of Alternative A would, for the most part, be approximately 60% of that occurring due to 500-MW Windplant construction (Table 4.10). Approximately 106 ac of crucial winter/yearlong range within the Medicine Bow Pronghorn Herd would be initially disturbed under Alternative A; this acreage represents 0.05% of this range type within the herd unit. LOP disturbance within pronghorn crucial range would decrease to 23 ac (i.e., 0.01%) with successful reclamation. Habitat loss within mule deer crucial winter/yearlong range for the Sheep Mountain Herd would remain the same as that for Phase I and 500-MW Windplant construction [i.e., 42 ac (0.03%) of new disturbance, and 0 ac LOP]. Impacts to the Medicine Bow Pronghorn Herd and the Sheep Mountain Deer Herd crucial winter/yearlong range would be moderate under Alternative A. The Platte Valley Mule Deer Herd would experience a negligible loss of 0.01% of winter/yearlong range (99 ac) and 0.07% of yearlong range (141 ac) due to the initial construction of Alternative A. Other big game range that would be impacted the same under Alternative A and the Proposed Action are yearlong range for the Shirley Mountain Mule Deer Herd (i.e., 2 ac new, 0 ac LOP) and Laramie River White-tailed Deer Herd (i.e., 15 ac new, 0 ac LOP). Impacts to the Snowy Range Elk Herd would be potentially significant under Alternative A due to both a 0.4% loss of winter/yearlong range (890 ac) and possible displacement from habitat adjacent to WTGs.

Other potential impacts to big game (e.g., displacement, noise, snow accumulation) would continue to be present under Alternative A, but may decrease somewhat in intensity and/or distribution.

No Action. No impacts to big game species or their habitats within the KPPA would occur under the No Action Alternative.

Cumulative Impacts. Habitat disturbance associated with Phase I activities represents 0.1% or less of various big game ranges (including crucial ranges) for the herd units of interest (Table 4.10). The largest percentage of big game range types disturbed by construction of the 500-MW Windplant would be winter/yearlong range for Medicine Bow Pronghorn (0.21%), Sheep Mountain Mule Deer (0.19%), and Snowy Range Elk (0.62%) Herds. Disturbance within winter/yearlong range for the Medicine Bow Pronghorn and Sheep Mountain Mule Deer Herds would decline to less than 0.10% of that available within the herd unit for the LOP. For the Snowy Range Elk Herd, LOP disturbance within winter/yearlong range would decline to 0.24% of that available within the herd unit.

Existing and foreseeable disturbance (e.g., oil and gas development, proposed windpower development, surface mining, roads) within crucial big game habitat for herds of interest are presented in Table 4.11. According to the significance criterion stated above, crucial habitat within each of the big game herd units currently is significantly impacted by existing and foreseeable disturbance. Indirect impacts to big game, such those related to noise and human disturbance (i.e., displacement), are difficult to quantify, but probably increase the overall level of cumulative disturbance within crucial range. The 140 ac of crucial winter/yearlong pronghorn range within the Medicine Bow Herd that would be disturbed by construction of the 500-MW Windplant represents an increase in total cumulative acreage of disturbance to this range of approximately 1.6%, for a total disturbance of 9,169 ac. Likewise, 500-MW Windplant development would result in an increase of 0.9% (42 ac) to existing cumulative acreage of disturbance within the crucial winter/yearlong range for the Sheep Mountain

Table 4.11 Cumulative Existing and Foreseeable Disturbance Within Crucial Habitat for Big Game Herd Units and Sage Grouse HMP Areas.[1]

	Pronghorn	Mule Deer			Elk	Sage Grouse
Disturbance Type	Medicine Bow Herd	Platte Valley Herd	Sheep Mountain Herd	Shirley Mountain Herd	Snowy Range Herd	Shirley Mountain and Saratoga Valley HMP Areas[2]
Oil and gas production[3]	14	0	48	0	20	11
Surface mining	435	0	410	0	0	14,289
Proposed Medicine Bow windfarm[4]	1,277	0	67	0	0	874
Urban development	273	0	8	0	5	179
Federal highway (i.e., I-80)[5]	642	715	376	0	0	188
State highways[6]	752	238	295	0	0	653
Other roads[7]	4,138	3,693	2,874	1,562	3,475	5,455
Railroad ROWs[8]	713	577	262	0	0	684
Pipeline ROWs[9]	459	183	111	37	66	420
Other[10]	326	54	40	32	19	170
Total disturbance	9,029	5,460	4,491	1,631	3,585	22,923
Total acreage of crucial habitat	227,584[11]	208,256[11]	158,080[11]	85,888[11]	191,104[12]	300,000[13]
Percentage of crucial habitat disturbed[14]	4.0	2.6	2.8	1.9	1.9	7.6

1 Disturbance calculated from 1:100,000 topographic maps and industry data; all disturbances in ac, and includes only acreage physically disturbed by development activities; multiply number of ac by 0.4047 to compute number of hectares.
2 Adapted from Medicine Bow-Divide Resource Area RMP data (BLM 1987:200).
3 Average oil/gas well disturbance considered to be 1.5 ac/well, which includes disturbance from associated access roads.
4 Approximate disturbance acreage based on initial project description submitted to BLM.
5 I-80 ROW = 500 ft (152 m).
6 State highway ROW = 100 ft (31 m).
7 Other roads include primary and secondary (i.e., local) roads; ROW = 50 ft (15 m).
8 Railroad ROW = 200 ft (61 m).
9 Pipeline ROW = 50 ft (15 m).
10 Other disturbances include airports, gravel pits, irrigation ditches, landing strips, quarries, and reservoirs.
11 Total acreage of crucial winter/yearlong range for the herd (WGFD 1994a).
12 Total acreage of crucial winter and crucial winter/yearlong range for the herd (WGFD 1994a).
13 Probable sage grouse nesting habitat includes areas within 2.0 mi (3.2 km) of known lek sites on HMP areas; adapted from BLM (1987:200) data.
14 Percentage of crucial habitat disturbed = $\frac{\text{total acreage of disturbance}}{\text{total acreage of crucial habitat}} \times 100$

Mule Deer Herd, for a total disturbance of 4,533 ac. Crucial range within the Platte Valley and Shirley Mountain Mule Deer Herds, as well as that within the Snowy Range Elk Herd, would not be additionally impacted by Windplant development. Although Windplant development may result in a slight increase in cumulative disturbance to some big game ranges (e.g., winter/yearlong range for elk), it would not substantially increase cumulative disturbance within crucial ranges for big game herds on and adjacent to the KPPA.

4.2.3.2 Other Mammals

Significance Criteria. Quantifiable criteria that specifically define the level at which disturbance of nongame (i.e., furbearers and other carnivores) and small mammal (i.e., insectivores, lagomorphs, and rodents) habitats becomes a significant impact to population health are not designated in the literature or by regulatory agencies. For this EIS, however, impacts to nongame and small mammals would be considered significant if project activities result in a decline in populations of these species.

Proposed Action. While nongame and small mammals would be negatively affected by increased traffic and human presence (i.e., O&M activities) within the KPPA, primary effects would occur in direct proportion to the amount of potential habitat removed by project construction. Approximately 319 ac of potential habitat would be disturbed due to Phase I construction, which represents approximately 0.5% of potential habitat within the KPPA. Construction of the 500-MW Windplant would disturb approximately 1,787 ac of potential nongame and small mammal habitat, or about 2.9% of the KPPA. Overall impacts to nongame and small mammal populations within the KPPA would likely be negligible due to the scattered distribution and extent of potential disturbance. A slight increase in direct nongame and small mammal mortality would initially occur due to Phase I and 500-MW Windplant construction, and would remain slightly elevated for the LOP due to increased traffic; this impact to populations would also likely be negligible.

Localized changes in nongame and small mammal habitats may occur as a result of changes in snow accumulation patterns induced by WTG placement (Section 4.1.1). For example, greater available moisture resulting from increased snow cover immediately downwind from a WTG array could, over several years, encourage shrub growth and change the microstructure of the present habitat. Although this may not be detrimental to the overall population of a given nongame or small mammal population within the KPPA, distribution patterns for these species may change; the extent of this change is difficult to predict. These changes may be significant for a localized area, but would tend to be moderate when considered for the entire KPPA. Also, the same changes that might be considered negative for a grassland species (i.e., change in forage species and increase in vertical structure) may be considered positive for a shrub-grassland species.

Alternative A. Impacts to habitats used by nongame and small mammals under this alternative would decrease by about 40% from levels identified for the Proposed Action. Therefore, impact levels would likely remain negligible.

No Action. No impacts would occur to nongame and small mammal populations within the KPPA under the No Action Alternative.

Cumulative Impacts. Regional cumulative impacts to nongame and small mammal habitats include mines (i.e., approximately 22,598 ac of disturbance, 5,741 ac of which is active at any one time), oil and gas development, proposed windpower development (i.e., 1,344 ac of potential disturbance from the proposed Medicine Bow Windfarm) and roads (e.g., federal and state highways, primary and secondary roads). The majority of this disturbance is scattered throughout the region, and probably presents a negligible impact to nongame and small mammal populations. Maximum cumulative disturbance within the KPPA (i.e., construction of the 500-MW Windplant plus existing disturbance) would total 2,226 ac, or 3.7% of the potential nongame and small mammal habitat within the KPPA. By implementing prompt revegetation and appropriate habitat protection measures (Section 5.1.3.10), cumulative impacts to nongame and small mammal populations within the region are expected to be negligible.

4.2.3.3 Legislation Related to Avian Mortality

The USFWS has contended that, in some circumstances, avian collision-related mortality may constitute violations of the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-711, as amended), the Bald Eagle Protection Act (BEPA) (16 U.S.C. 668-668d, as amended), the Endangered Species Act (ESA) (16 U.S.C. 1531-1543) and/or Wyoming Statutes 23-1-101 and 23-3-101 unless appropriate permits are obtained and steps are taken to minimize detrimental impacts. The MBTA provides for regulations to control taking, selling, transporting, and importing migratory birds, their nests, eggs, parts, or products. Migratory birds include all birds in North America except gallinaceous birds (e.g, grouse, turkey, quail), starlings, rock doves/pigeons, and house sparrows. Migratory game birds (i.e., ducks, geese, cranes, and mourning doves) may be taken during seasons set by the state of Wyoming in conjunction with the USFWS.

These laws were primarily designed to penalize active, intentional conduct such as unpermitted hunting or commercial use. There have been conflicting court decisions about whether and in what circumstances these taking prohibitions apply to unintentional conduct such as the construction or maintenance of facilities with which birds or other protected species might collide or otherwise be harmed. USFWS has issued a memorandum which focuses the inquiry in these circumstances on the windpower developer's efforts to reduce the impacts on wildlife and to develop safer windpower technology, rather than viewing individual collisions as violations of the law. USFWS has not yet determined whether particular avian mortality permits will be required for Windplant installation, insofar as it will not consider takings violations to occur where the operator is exercising such appropriate care.

The MBTA provides for the issuance of Migratory Bird Permits (50 C.F.R. 21) to allow take of migratory birds for various purposes such as falconry, scientific research, control of depredation, or special purposes. Special purpose permits (50 C.F.R. 21.27) ". . . may be issued for special purpose activities related to migratory birds . . . .". Such an application must show " . . . a benefit to the migratory bird resource, important research reasons, reasons of human concern for individual birds, or other compelling justification" in addition to other general permit requirements (50 C.F.R. 13).

The ESA provides for the conservation of T&E species. Mortality or injury to T&E avian species known to occur (bald eagle and peregrine falcon) or potentially occur (whooping crane) within the KPPA might, in some circumstances, be considered a take under the ESA. Regulatory provisions of the ESA (50 C.F.R. 17.22) provide for the issuance of an Incidental Taking Permit which may authorize a single transaction, a series of transactions, or a number of activities over a specific period of time. Incidental taking is defined as " . . . any taking otherwise prohibited, if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." (50 C.F.R. 17.3). Permit applications require the filing of a conservation plan which specifies:

- impacts that would result from the incidental take;
- steps the applicant will take to monitor, minimize, and mitigate identified impacts, and the funding available to implement such measures; and
- any alternative actions considered to the take and the reasons such alternatives were not adopted.

Permits may be issued if:

- the take is incidental,
- the applicant will, to the maximum extent practicable, minimize and mitigate impacts of the take;
- adequate funding is provided for the conservation plan;
- the take will not appreciably reduce the likelihood of the survival and recovery of the species in the wild; and
- the applicant meets any other requirements imposed by the Director of the USFWS.

The BEPA provides for the protection of bald eagles and golden eagles by prohibiting the taking, possession, and commerce of these birds. The BEPA also provides for the issuance of taking permits for scientific or exhibition purposes, for Native American religious purposes, for taking depredating eagles, for falconry purposes, and for taking golden eagle nests. There are no regulatory provisions for incidental takings as there are under the ESA or MBTA.

WGFD laws afford protection to protected birds (W.R.S. 23-1-101), and specifically, eagles (W.R.S. 23-3-101). Permits may be issued to allow work with birds for scientific, falconry, or other purposes authorized by the Wildlife Commission.

While it is relatively certain that some migratory birds or other protected species would collide with Windplant structures, the USFWS generally supports windpower development to provide a clean, renewable energy source. In early 1994, the USFWS developed a written policy regarding the effects of wind turbines on wildlife:

> The policy is that the Service will enforce regulations associated with the Migratory Bird Treaty Act, 16 U.S.C. 703-712 (sic), the Bald and Golden (sic) Eagle Protection Act, 16 U.S.C. 668, and the Endangered Species Act.
>
> The Service supports the Administration's goal of developing and expanding renewable energy sources such as windpower. Therefore, the Service will assist the windpower industry with development of windpower technology that is not detrimental to wildlife. Hopefully such actions as modification of site placement, changes in operating schedules, and equipment modification can be developed to reduce the impact of windpower on wildlife.

The USFWS has a stated intent "to improve communications, working relationships with the industry, and to assist with development of safer windpower technology . . . .". Which permits would be issued and what conditions would be included for the Proposed Action have not yet been determined, and negotiations between KENETECH and the USFWS are on-going. Whether or not a permit for limited taking of protected species is issued, the USFWS may direct that the Windplant be constructed and operated to meet certain stipulations to reduce impacts to birds and other wildlife. Stipulations would include, but are not limited to, using state-of-the-art technology known to minimize wildlife impacts [e.g., using results of research conducted by the avian task force (see Section 2.1.11)], locating facilities away from known avian concentration areas, and scheduling Windplant operations to avoid disturbing avian wildlife during defined critical periods. These negotiations have lead to the proposed use of tubular towers rather than lattice towers for the proposed project because, in some circumstances, with some facilities in California, lattice towers appear to cause greater avian mortality than tubular towers (Orloff and Flannery 1992).

4.2.3.4 Raptors

Significance Criteria. Impacts to raptors would be considered significant if project-related activities resulted in:

- violation of the MBTA, the BEPA, and/or the ESA; and/or
- declining raptor populations.

Proposed Action. Potential impacts of the proposed Windplant to raptor populations could be direct or indirect. The direct effect would be collision-related mortality; indirect effects would include changes in essential habitat components (e.g., prey availability, nesting sites) which may indirectly affect mortality rates and/or raptor reproductive success. Both direct and indirect impacts are potentially significant.

The proposed Windplant would be the first industrial scale windpower facility in Wyoming, and potential raptor mortality is unknown. Two large [257 ft (78 m) and 300 ft (91 m) rotor diameter] wind turbines near Medicine Bow, Wyoming were monitored for a six-year period from 1978 to 1983 (Yeo et al. 1984). No raptor mortalities were recorded at either turbine, but these results are not entirely applicable to the Proposed Action since turbine types, location, size, and numbers are dramatically different. Raptor mortality studies have been conducted at Windplants in California (i.e., Altamont Pass and the Montezuma Hills), where a wide variety of turbine types is used (Howell and DiDonato 1991, 1989, 1988; Howell and Noone 1992; Howell et al. 1991a, 1991b; Orloff and Flannery 1992). The methodology used to document mortality in California is limited to estimating the species and number of birds killed, but not effects on populations. Birds were not marked, hence impacts of turbine mortality on local raptor populations cannot be quantitatively evaluated because it is not known in what proportions breeding birds and floaters (i.e., nonbreeding, nonresident birds) were killed. Furthermore, only one California study evaluated potential changes in raptor densities after windfarm construction by measuring raptor abundance during both pre- and post-construction of the Montezuma Hills windfarm (Howell and Noone 1992).

Researchers at California Windplants have concluded that the magnitude of turbine-caused raptor mortality is related to raptor abundance, behavior, and flight characteristics (Howell and DiDonato 1991, Howell and Noone 1992, Orloff and Flannery 1992). The turkey vulture was the most commonly seen raptor at California Windplants, but had very low mortality (Table 4.12), possibly because scavenging does not involve high-speed flight or highly focused concentration. Conversely, hunting birds like the American kestrel, which had a higher mortality rate than predicted from its relative abundance, may be less aware of obstacles in their flight path (Orloff and Flannery 1992). In addition to flight behaviors such as flight speed, flight height may also contribute to risk of turbine collision; those species that typically fly at rotor height [26-184 ft (8-56 m)] would have a greater risk of collision. Flight-height data collected on Foote Creek Rim show that 49% of eagles observed, 53% of hawks observed, and 62% of large falcons (prairie falcon, peregrine falcon) observed were within the turbine rotor height class; while 27% of small falcons (American kestrel, merlin), 15% of northern harriers, and 17% of accipiters were observed in the turbine rotor height class (Table 3.12). Given the characteristics that may contribute to turbine collision, it is possible to rank species in order of potential risk of collision. The most abundant species with hunting flight behavior that flies at rotor height may have the greatest risk of collision; while uncommon, high-flying, scavenging raptors would potentially have the lowest risk of turbine collision (Howell and DiDonato 1991, Howell and Noone 1992, Orloff and Flannery 1992).

The populations of most raptor species observed on the KPPA (except for federally listed, or candidate species) are generally assumed to be widely distributed and stable (Olendorff 1973, Newton 1979). However, while abundance (i.e., average occurrence) has been calculated for raptor species seen on Foote Creek Rim (Table 4.12), there is a lack of accurate information on local raptor population structures (personal communication, January 1995, with Tamara Holmes, University of Colorado Health Sciences). If raptor populations are, in fact, widely distributed and panmictic (random breeding within a population), resident birds killed by the Windplant would probably be replaced by immigrating individuals and populations may not

Table 4.12 Average Occurrence Per 10-min Scan for Raptors at California Windfarms and at Foote Creek Rim, Wyoming, and Number of Carcasses Recovered at California Windfarms for Each Species.[1]

	Location										
	Altamont Pass						Montezuma Hills			Foote Creek Rim	
Species	No. Observed per 10-min Scan[2,3]	Rank	No. Carcasses Recovered	Occurrence[2,4] (No. Observed per 10-min Scan)	Rank	No. of Carcasses Recovered	Occurrence[2,5] (No. Observed per 10-min Scan)	Rank	No. Carcasses Recovered	Occurrence (No. Observed per 10-min Scan)	Rank
American kestrel	0.046	5	0	0.053	4	20[6]	0.362	3	5	0.121	2
Bald eagle	0.000	–	0	0.012	7	0	<0.001	9	0	0.012	7
Ferruginous hawk	0.056	4	0	0.051	5	2	0.020	7	0	0.053	4
Golden eagle	0.198	3	2[6]	0.194	3	16[8]	0.090	5	1	0.289	1
Northern harrier	0.010	7	0	0.014	6	0	0.138	4	0	0.039	5
Prairie falcon	0.014	6	0	0.008	8	0	0.076	6	0	0.034	6
Peregrine falcon	0.000	–	0	0.002	9	0	<0.001	9	0	0.006	9
Red-tailed hawk	0.356	2	9[6]	0.301	2	54[8]	0.800	2	6	0.099	3
Swainson's hawk	0.000	–	0	0.000	–	0	0.001	8	0	0.034	6
Turkey vulture	0.415	1	0[7]	0.356	1	0[7]	1.150	1	0[7]	0.003	8

[1] California average occurrence is for all seasons and years combined; Foote Creek Rim average occurrence is calculated from weekly raptor surveys conducted from June 29 through October 26, 1994 (Foote Creek Rim raptor surveys will continue indefinitely) (Mariah 1994a). The Foote Creek Rim portion of the table includes only those species for which occurrence data were available for comparison.
[2] See Table 4.13 for study methodology.
[3] Howell and DiDonato (1991).
[4] Orloff and Flannery (1992).
[5] Howell and Noone (1992).
[6] Turbine-caused mortality was higher than predicted from relative abundance.
[7] Turbine-caused mortality was lower than predicted from relative abundance.
[8] Turbine-caused mortality of adults and immature birds was higher than predicted from relative abundance.

decline. However, if a population structure were such that recruitment was local, Windplant-related mortality might conceivably have a significant impact on some populations. Regardless of population structure, there is the potential for loss of production through nest abandonment if a parent bird is killed by turbine collision. Because total number of nesting territories and geographic origins of resident birds and their movement patterns are unknown for this area, potential impacts on raptor populations are difficult to quantify.

For the purposes of this EIS, the number of raptor carcasses collected at California windfarm sites was used to estimate mortality rates for four raptor species (American kestrel, ferruginous hawk, golden eagle, red-tailed hawk) common to both Wyoming and California for which carcasses were recovered in California (Howell and Noone 1992, Orloff and Flannery 1992). California data are being used because California windfarms are the only source of large-scale Windplant mortality estimates available. Estimated mortality rates presented herein are subject to many assumptions and possible large errors (see below). These calculations provide only an initial estimate of potential mortality, which would be revised and improved during monitoring.

California mortality rates for the four raptor species were calculated by dividing the number of individuals of each species killed per unit time by the number of turbines sampled (Tables 4.13 and 4.14). The California mortality rates were applied to the proposed Phase I and the 500-MW Windplant (Table 4.14). For example, average annual golden eagle mortality at Altamont Pass, California, was 8 carcasses; this number was divided by 1,169 turbines for an annual mortality rate of 0.007 raptors/turbine (Orloff and Flannery 1992). This rate was multiplied by number of turbines proposed for Phase I and the 500-MW Windplant to generate the annual mortality estimates listed in Table 4.14.

Based on California mortality rates, golden eagle mortality is predicted to range from 0.402 (±0.569) to 1.307 (±0.995) eagles per year for Phase I (201 turbines), and 2.780 (±3.932) to 9.035 (±6.880) eagles per year for the 500-MW Windplant (Table 4.14). This may be an underestimate because golden eagles are more abundant on the KPPA then at the California Windplant (Table 4.12). Furthermore, both adult and immature golden eagles were killed more often than expected by their abundance (Table 4.12) (Howell and DiDonato 1991, Orloff and Flannery 1992).

Possible ferruginous hawk mortality at the proposed Windplant is a concern because the ferruginous hawk is a C2 species. No ferruginous hawks were recovered from the Montezuma Hills Windplant. Based on Altamont Pass data, estimated average mortality would be 0.201 birds per year for Phase I, and 1.390 birds per year for the 500-MW Windplant (Table 4.14). This species breeds in Wyoming (17 active nests in the 1994 nest survey area), but only winters in California, so the mortality estimate is probably low (Table 4.14).

Estimated American kestrel mortality would range from 1.709 (±1.279) to 2.513 (±0.142) per year for Phase I, and 11.815 (±8.846) to 17.375 (±0.983) per year for the Proposed Action. This estimate may be low because carcasses are difficult to recover since this raptor's small size may result in increased scavenging rates and decreased searcher efficiency. Scavenging trials conducted at California Windplants demonstrated that eagle-sized raptors were not removed by scavengers, whereas about one-half of all kestrel-sized raptor carcasses were removed after seven days (Howell and Noone 1992, Orloff and Flannery 1992). However, American kestrels are year-round residents at the California site, while most leave southern Wyoming during winter, which may partially offset the small carcass recovery bias (Table 4.14).

Estimated red-tailed hawk mortality ranges from 1.910 (±1.848) to 5.025 (no standard deviation associated with this number) per year for Phase I, and 13.205 (±12.770) to 34.750 (no standard

Table 4.13 Average Number of Raptor Carcasses Recovered Annually at Five Wind Turbine Sites and Description of Sampling Characteristics.

Investigator	Species: American Kestrel (Mean ±SD)	Golden Eagle (Mean ±SD)	Ferruginous Hawk (Mean ±SD)	Red-tailed Hawk (Mean ±SD)	Sampling Characteristics: Sampling Period	No. Turbines Sampled	Primary Tower Type
Howell and Noone (1992)[1]	2.5 ± 0.71	0.5 ± 0.71	0	3 ± 2.83	2 years/weekly search year-round	170 (1st yr.); 230 (2nd yr.)	Lattice
Orloff and Flannery (1992)[2]	10 ± 7.10	8 ± 5.66	1 ± 0[3]	27 ± 11.31	2 years/weekly search for 3 five-week sampling periods each year	1,169	Lattice
Howell and DiDonato (1991)[2]	0	2 ± 0	0	9 ± 0	1 year/twice monthly search, year-round	359	Lattice
Howell (unpubl. data)[4]	0	0	0	0	1 year/twice weekly searches, year-round	39	Lattice
Higgens (unpubl. data)[5]	0	0	0	0	May - Sept. 1994/weekly search	Random sample of 73	Tubular

[1] Turbines located in Montezuma Hills, California.
[2] Turbines located at Altamont Pass, California.
[3] Standard error is 0 because only one carcass was recovered each year.
[4] Turbines located in California (personal communication with Judd Howell, Judd Howell and Associates, September 1994).
[5] Turbines located in Minnesota (personal communication with Kenneth Higgens, South Dakota State University, October 1994).

Table 4.14 Estimated Average Number of Raptor Carcasses that Would Be Recovered Annually from the Wyoming Windplant Using Carcass Recovery/Turbine Rates from Three California Windfarm Studies.[1]

Species	Average Mortality/Turbine/ Year ± SD	Estimated Mortality/Year ± SD		
		Phase I (201)[2]	Full (1,390)[2]	Alternative A (835)[2]
A.[3]				
American kestrel	0.009 ± 0.006	1.709 ± 1.279	11.815 ± 8.846	7.098 ± 5.314
Ferruginous hawk	0.001[4]	0.201	1.390	0.835
Golden eagle	0.007 ± 0.005	1.307 ± 0.995	9.035 ± 6.880	5.428 ± 4.133
Red-tailed hawk	0.010 ± 0.009	1.910 ± 1.848	13.205 ± 12.770	7.933 ± 7.676
B.[5]				
American kestrel	0.013 ± 0.001	2.513 ± 0.142	17.375 ± 0.983	10.438 ± 0.590
Golden eagle	0.002 ± 0.003	0.402 ± 0.569	2.780 ± 3.932	1.670 ± 2.362
Red-tailed hawk	0.014 ± 0.011	2.814 ± 2.274	19.460 ± 15.726	11.690 ± 9.447
C.[6]				
Golden eagle	0.006[7]	1.206	8.340	5.010
Red-tailed hawk	0.025[8]	5.025	34.750	20.875

1 See Table 4.13 for sampling method description.
2 Proposed number of turbines noted in parentheses.
3 Orloff and Flannery (1992).
4 No standard deviation (SD) associated with this number, since sample size was 1 for both years (i.e., SD = 0)
5 Howell and Noone (1992).
6 Howell and DiDonato (1991).
7 This number is not an average because carcasses were collected for only one year.
8 This number is based on one year of data, and therefore, is not an average and has no SD associated with it.

deviation) per year for the 500-MW Windplant. California researchers reported that both immature and adult red-tailed hawks were killed more often than would be predicted by their relative abundance (Howell and DiDonato 1991, Orloff and Flannery 1992). However, red-tailed hawks are not nearly as abundant in the KPPA as they are at Altamont Pass or Montezuma Hills (Table 4.12); hence, this mortality estimate may be high.

Due to numerous physical and biological differences between California and the proposed Wyoming Windplant sites, these raptor mortality estimates are limited and most likely will change as data are collected during monitoring (Appendix B). Specific limitations of using California mortality data to estimate wind turbine-caused mortality within the KPPA include, but are not limited to:

- Mortality rates in California were highly variable both temporally and spatially, causing large standard deviations for estimated average raptor mortality (Table 4.14). Seasonal, yearly, and spatial variation in mortality (e.g., Foote Creek Rim vs. the Simpson Ridge area) should be expected at the proposed Wyoming Windplant as well. For example, given the decline in raptor observations during winter [Figure 3.2(C and D)], it is expected that potential raptor mortality will be much lower during winter than during other seasons. Hence, actual annual mortality rates may not fall within the estimated ranges.
- Carcasses were primarily recovered from turbines on lattice towers. Orloff and Flannery (1992) associated lattice towers with higher raptor mortality rates compared to other turbine types. Tubular towers associated with lower raptor mortality rates in preliminary research (Table 4.13) would be used for the Proposed Action. Other turbine differences (e.g., operation time, rotor color, variable speed vs. fixed speed, upwind vs. downwind, turbine design, rotor diameter, swept area, etc.) may also affect mortality rates, but the influence of these turbine modifications on raptor mortality cannot be quantified at this time (Section 5.1.3.11).
- Twenty-five off-site raptor mortalities (including seven golden eagles) were reported at Altamont Pass (Orloff and Flannery 1992), and six off-site raptor mortalities were reported at Montezuma Hills (Howell and Noone 1992), but could not be directly linked to turbine collisions (i.e., the mortality occurred due to the Windplant, but specific cause of death could not be accurately determined) and thus, were not included in KPPA mortality estimates.

A final limitation of the California mortality estimates is that nesting densities are not comparable between sites because the California reports do not always state the site of the area surveyed. Furthermore, the effect of nest density on turbine-caused mortality for raptor species remains unknown. For example, Montezuma Hills and Altamont Pass Wind Resource Areas (WRAs) had similar raptor mortality rates, although raptor nesting density was higher at Montezuma Hills than at Altamont Pass (Howell and Noone 1992, Orloff and Flannery 1992). Also, Howell and DiDonato (1991) reported an inverse relationship between avian mortality and nesting densities at Altamont Pass where one site with 19 raptor nests had a significantly lower raptor mortality rate than another site with 7 nests. Orloff and Flannery (1992) reported that raptor mortality was randomly distributed throughout the Altamont Pass WRA.

Turbine-caused mortality for common raptors not listed in Table 4.14 cannot be quantified due to lack of mortality data for these species. No bald eagle, prairie falcon, Swainson's hawk, or northern harrier carcasses were recovered at either California site, although one prairie falcon was recovered off-site (Howell and Noone 1992). However, because of higher abundances of these species within the KPPA compared to California (Table 4.15), mortality of these species is likely

Table 4.15 Comparison of Raptor Species Distribution[1] in Southern Wyoming vs. California.

	State	
Species	Wyoming	California
Bald eagle[2,4]	Resident[3], infrequent, winter population increases	Resident, infrequent
Golden eagle[4]	Resident, common	Resident, common
Ferruginous hawk[5]	Seasonal resident, common during breeding season, rare during winter	Does not breed in California, uncommon winter resident
American kestrel	Seasonal resident, common during breeding season, some stay through winter	Resident, common
Merlin	Resident, uncommon during breeding season to rare during winter	Common winter resident
Northern harrier	Seasonal resident, common during breeding season, some stay through winter	Resident, common, population declining throughout California[6]
Prairie falcon	Resident, common, larger breeding population on KPPA than at California windfarms	Resident, uncommon
Red-tailed hawk	Resident, common	Resident, common
Rough-legged hawk	Common winter resident	Common to uncommon winter resident
Swainson's hawk	Seasonal resident, common during breeding season	Uncommon during breeding season[7]

1 Distribution information taken from Wyoming Bird and Mammal Atlas (WGFD 1992), and Field Guide to the Birds of North America (Scott 1987).
2 Federally endangered.
3 Breeds and remains in the area year-round.
4 Protected under the BEPA.
5 Federal candidate species: C2.
6 Species of special concern in California [California Department of Fish and Game (CDFG) 1991].
7 California threatened (CDFG 1991).

under the Proposed Action. Most notably, active bald eagle, prairie falcon, and Swainson's hawk nests were located within the 1994 raptor survey area (Table 3.13), and none of these species nested in California Windplant areas.

Although most documented on-site mortality in California was directly associated with collisions with wind turbines, other Windplant facilities may also impact raptors. Collisions with electrical and guy wires caused 18% of raptor deaths in Altamont Pass (Orloff and Flannery 1992). Facilities within the KPPA would be constructed to minimize impacts to raptors. The 230-kV transmission line would be constructed as recommended by Olendorff et al. (1981) to eliminate potential for raptor electrocution. Ground wires would be marked where the transmission line crosses the Medicine Bow River and Foote Creek. Transmission lines would be periodically monitored; if some portions of the lines have high collision rates, ground wires in these areas would be marked.

In addition to potential direct effects (mortality), indirect effects on raptor populations are also possible (changes in perching, foraging, or nest site availability). The proposed 500-MW Windplant could potentially impact raptor use within and adjacent to the KPPA (Table 3.11). Although many Windplant facilities would be equipped with antiperching devices, raptor perching within the KPPA is expected to increase. There are very few perching sites in the Foote Creek Rim area, so any facilities that afford a view would probably be used by raptors. Raptors have been observed perching on meteorological towers, idle turbine blades and on power lines (Smith 1985, Faanes 1987, Howell and Noone 1992, Orloff and Flannery 1992, Mariah Associates Inc., 1994a). No raptors have been observed perching on WTGs with tubular towers (personal communication, September 1994, with Judd Howell, Judd Howell and Associates), but it is possible that they can be used as perch sites. Other perching sites created by the Windplant would include fencing around substations, transformers, downtower boxes, and power lines. Power line structures within the Windplant would be equipped with antiperching devices, and the 230-kV transmission line would be equipped with antiperching devices in the vicinity of prairie dog colonies and sage grouse leks to minimize predation on BFFs and sage grouse (Sections 4.2.4.2 and 4.2.3.5). Raptors that frequently perch on or near turbines may habituate to turbines, resulting in a decreased awareness of danger (Orloff and Flannery 1992); but this has not been tested, and effects of habituation to turbines on raptor mortality remains unknown.

Food availability is one of two primary factors that may potentially limit raptor populations (Newton 1991). Impacts of the Proposed Action on prey availability are unknown, but would be monitored beginning with Phase I of development (Appendix B). If prey availability decreases, raptor reproductive success and/or winter survival could also decrease. Alternatively, prey increases within the KPPA could improve reproductive success; however, increased prey could also attract raptors to turbine sites, possibly resulting in increased raptor collision rates.

Nest site availability, the other principal potential limiting factor of raptor populations, is probably not limited within the KPPA. In 1994, 308 active and/or inactive nests were known to occur within the KPPA. The total number of nests does not represent the total number of territories because each territory may have two to three alternate nests (Newton 1979). History of territory occupancy is unknown for the KPPA, hence average annual number of occupied territories in the area is also unknown. However, given the large number of raptor nests within KPPA, suitable nest sites are probably not limiting for most species. Erection of wind turbines would not increase nest site availability because raptors probably would not be able to build nests on tubular turbines (personal communication, September 1994, with Judd Howell, Judd Howell and Associates). Raptors nest on poles along transmission lines (Steenhoff et al. 1993), and although wildlife boots will be placed on poles above sage grouse leks and prairie dog towns to prohibit nesting in these areas, the numerous other power line structures could provide nest sites. On- or off-site mitigation may include erection of nesting platforms.

The Hanna RCA overlaps with the Simpson Ridge portion of the KPPA, and density of raptor nests in this area is higher than anywhere else within the 1994 nest survey area (Section 3.2.2.3). Raptor displacement from this preferred habitat could adversely affect populations because displaced birds could be forced to utilize other less suitable areas which may result in lower reproductive success. The availability of alternate nest sites and adequate prey would affect the magnitude of this impact. Available nesting habitat could decrease through physical loss of land (Table 4.1) as well as human disturbance (e.g., construction and O&M activities). No project-related activities would occur from February 1 through August 1 within the 0.75-mi (1.21-km) buffer around each active nest, unless otherwise approved by the BLM.

In summary, raptor mortalities have been reported at Windplants in California, which suggests that turbine-caused raptor mortality will occur due to the Proposed Action. The most abundant raptor species that tend to fly at wind turbine rotor height may have the highest risk of turbine collision (Howell and Noone 1992, Orloff and Flannery 1992). Two primary raptor species of concern which occur on the KPPA are the golden eagle and ferruginous hawk; both commonly fly at rotor height and are the first and fourth most commonly seen raptors on the KPPA, respectively (Table 4.12). The biological impact of turbine-caused mortality on these raptor populations depends on a variety of factors, including the mortality rate at the proposed Wyoming Windplant, and species-specific population dynamics (which are influenced by other factors such as prey availability). There is a lack of accurate information on local golden eagle and ferruginous hawk population structure. Golden eagle populations in the western United States are commonly described as widely distributed and stable (Olendorff 1973, Newton 1979); hence, low turbine-caused mortality rates for this species may not significantly impact the population. However, the ferruginous hawk is a C2 species, indicating there is cause for concern about its population size. Potential impacts of turbine-caused mortality may be greater for this species given the sensitive status of its population. If monitoring of raptor mortality on the KPPA suggests potential negative impacts to raptor populations, detailed studies of raptor population dynamics may be initiated to determine the significance of the impacts (Appendix B).

Alternative A. Alternative A impacts the same area and number of raptor nests as the Proposed Action, but would have 40% fewer turbines. Under Alternative A, potential impacts from violations of federal laws or Windplant-related population declines could be significant, as described for the Proposed Action.

Mortality rates under Alternative A probably would be lower than for the Proposed Action (Table 4.14), but may not be reduced by 40% because factors such as turbine characteristics and placement could influence mortality rates (Howell and Noone 1992; Orloff and Flannery 1992). As with the Proposed Action, the monitoring program would be used to obtain site-specific mortality estimates and identify appropriate mitigation measures for phases subsequent to Phase I.

No Action. Under the No Action Alternative, no impact to raptors due to Windplant development would occur.

Cumulative Impacts. It is generally assumed that regional populations of common raptors are widely distributed and stable (Olendorff 1973; Newton 1979; personal communication, January 1995, with Tamara Holmes, University of Colorado Health Sciences). However, the dynamics of local raptor populations within and around the KPPA are unknown, hence, cumulative impacts are difficult to evaluate, since the potential area of impacts cannot currently be defined. If raptor populations in the area are panmictic, birds may readily disperse throughout southern Wyoming since there are no obvious physiographic boundaries that would prevent movement of raptors. Raptors displaced by the Windplant could move to other territories if suitable habitat is available. However, existing and proposed developments in the Great Divide and Green River Resource Areas (Map 4.1) could affect availability of suitable habitat. If local raptor populations are being affected by other developments, climatic influences, or other factors, mortality within the KPPA could be additive, and raptor populations may decline over time. Furthermore, the proposed Medicine Bow windfarm would constitute another potential source for direct mortality, as well as displacement. This potential additive effect would be more severe if raptor populations have localized recruitment and movements.

The monitoring program described in Appendix B would be implemented, beginning with the first phase of development, to determine whether actual mortality rates could affect raptor populations. The POD process described in Section 2.1.2 provides BLM with mechanisms for evaluating impacts of each phase and taking the necessary steps to prevent raptor population impacts caused by the Proposed Action or Alternative A. Monitoring would also help define the area of potential cumulative impacts and clarify potential effects of other developments in southern Wyoming on raptor populations.. If it is determined that raptor populations are widely distributed, cumulative impacts of the Proposed Action should be viewed on a regional scale and further monitoring of raptor populations would be necessary to determine how much disturbance and displacement local raptor populations can tolerate.

4.2.3.5 Upland Game Birds

Significance Criteria. Impacts to upland game bird (i.e., sage grouse, blue grouse, and mourning dove) populations would be considered significant if project construction and operation contributed to the decline of these populations within the KPPA.

Proposed Action. Approximately 300,000 ac of probable sage grouse nesting habitat occurs in the two HMP areas within which the KPPA occurs (Table 4.10). Construction of Phase I of the Proposed Action would result in the disturbance of 110 ac of probable sage grouse nesting habitat, or 0.04% of this habitat type within the two HMP areas (Table 4.10). Most of this disturbance would be along the transmission line ROW and would virtually disappear following successful reclamation; only about 2 ac of disturbance within probable sage grouse nesting habitat would remain for the LOP. Approximately 1,185 ac of probable nesting habitat (see Section 3.2.2.4, Sage Grouse, for definition) would be disturbed during construction of the 500-MW Windplant, which represents approximately 0.4% of this habitat within the two HMP areas. LOP disturbance within probable nesting habitat would be 471 ac (i.e., 0.2% of this habitat within the two HMP areas). No WTGs would be situated within the 3,115 ac of potential sage grouse breeding habitat on the KPPA. A standard BLM wildlife stipulation prohibits activity or surface disturbance within 0.25 mi (0.40 km) of an existing sage grouse lek center; however, the AO, in consultation with the WGFD, may grant exceptions to this stipulation. It is unlikely that habitat loss and disturbance associated with the Proposed Action would result in a decline in local sage grouse populations (i.e., a significant impact). If sage grouse populations contimue to decline in Wyoming (WGFD 1994d), however, the probable nesting habitat loss associated with the 500-MW Windplant could become a significant impact (i.e., especially on a local level).

Yeo et al. (1984) determined that there was no decrease in sage grouse lek attendance due to construction or operation of a large WTG immediately north of the KPPA; variations in lek attendance could not be directly attributed to the presence of the WTG. On the other hand, mining activity at a surface coal mine in North Park, Colorado, contributed to a drop in male sage grouse attendance at leks closest to mining activity and, over time, altered the distribution of breeding grouse (Remington and Braun 1991). Since the

WTGs of the proposed project would not be located within sage grouse breeding habitat, it is unlikely that their presence would result in a significant negative impact to sage grouse populations. However, leks located immediately adjacent to existing roads could experience some disturbance from increased traffic due to project activity.

A slight increase in sage grouse mortality could result from the presence of WTGs and the 230-kV transmission line due to fatal collisions. In Utah, sage grouse collision fatalities were associated with roadside overhead telephone wires (Borell 1939). Several dead sage grouse were found below a section of 230-kV transmission line in Montana, and carcasses evidenced contact trauma (i.e., severe mutilation of necks, wings, breasts, and abdomen) (Myers 1977). Myers (1977) noted that sage grouse fly at heights of 30 to 40 ft (9 to 12 m). Some sage grouse within the KPPA may collide not only with the proposed transmission line, but also with the lower reaches of moving rotors. However, given the relative infrequency of sage grouse flights (i.e., usually limited to escape reactions, movements to foraging areas, short elevational migrations), it is unlikely that these collisions would be numerous or result in a significant impact to sage grouse populations within the KPPA.

Potential changes in snow distribution due to WTGs and downtower structures may influence the amount of winter habitat available to sage grouse on the KPPA. Hupp and Braun (1989) noted that sage grouse in the Gunnison Basin of Colorado favored winter habitat with low snow cover. In winter, areas immediately leeward of WTGs and other structures would develop snow drifts and become unusable to sage grouse. Given the limited area covered by these drifts, however, these changes would likely not result in significant negative impacts to sage grouse populations, but may alter the distribution of wintering birds in the KPPA.

It is unlikely that noise related to the Proposed Action would adversely impact sage grouse reproductive success. Male sage grouse strut, fan their tail feathers, and produce a popping sound by rapidly inflating and deflating air sacs as part of their courtship display to attract females (Scott 1987). The noise generated by the proposed WTGs would, for the most part, not exceed the existing ambient noise level occurring at sage grouse leks within the KPPA (Section 4.1.8.2).

Impacts to mourning dove and blue grouse within the KPPA would likely be negligible. Some doves may collide with WTGs; however, given the low number of mourning doves observed crossing the rim (Mariah 1994a), it is unlikely that these collisions would be numerous enough to negatively impact mourning dove populations within the KPPA. WTGs would not be constructed within potential blue grouse habitat.

Alternative A. Approximately 754 ac of probable sage grouse nesting habitat would be disturbed due to construction of Alternative A (Table 4.10); this is about 36% less initial disturbance than would occur with the construction of the 500-MW Windplant. LOP disturbance under Alternative A would be approximately 282 ac. Impacts to sage grouse populations due to construction and operation of Alternative A would likely be moderate; initial disturbance (i.e., that prior to complete reclamation) could be significant if sage grouse populations within Wyoming continue to decline (WGFD 1994d). Other impacts (e.g., development activity, collision mortality, snow accumulation) would be present, but lower in intensity than described for the 500-MW Windplant.

No Action. No impacts to sage grouse, blue grouse, or mourning dove populations within the KPPA would occur under the No Action Alternative.

Cumulative Impacts. Existing and foreseeable cumulative disturbance (e.g., oil and gas development, surface mining, proposed windpower development, roads) within nesting habitat for sage grouse in the two HMP areas amounts to 22,923 ac, or 7.64% of this habitat type

(Table 4.11). Given the fact that sage grouse populations throughout Wyoming have been declining over the past several years and that this decline is attributed to habitat loss (WGFD 1994d), this level of disturbance should probably be considered a significant impact to populations within HMP areas. Phase I Windplant construction would increase this cumulative disturbance by about 0.05%, which is a negligible additional cumulative impact. Construction of the 500-MW Windplant, however, would increase existing cumulative disturbance to sage grouse nesting habitat by approximately 5.2%; this is likely a significant increase to an already heavily impacted resource (WGFD 1994d).

4.2.3.6 Waterfowl, Shorebirds, and Waders

Significance Criteria. Impacts to waterfowl, shorebirds, and waders would be considered significant if mortalities resulted in declining populations or violations of the MBTA and ESA as discussed in Section 4.2.3.3.

Proposed Action. There is potential for direct (i.e., mortality) and indirect (e.g., habitat displacement) impacts on waterfowl, shorebirds, and waders due to Windplant development. Both direct and indirect impacts are potentially significant. At Windplants in the U.S. (Montezuma Hills), only one waterfowl mortality (mallard), has been recorded (Howell and Noone 1992). No shorebird or wader mortality has been recorded at any Windplant in the U.S. At a single large turbine located on the coast of Denmark, three water bird carcasses (a gull, a duck, and a coot) were recovered during a two-year study (Pedersen and Poulsen 1991). However, no mortality was observed during a survey of mid-sized turbines [33-98 ft (10-30 m) towers, 23-82 ft (7-25 m) rotors] along the coast of the Netherlands (Winkelman 1985). Most researchers have concluded that turbine-caused mortality is not biologically significant for these species, based on low mortality rates and presumed large populations (Howell and DiDonato 1991, Howell et. al 1991b, Orloff and Flannery 1992). However, the absence of carcass recovery may reflect problems with sampling design or searcher efficiency and not the absence of Windplant mortalities.

The proposed Windplant would be the first industrial scale windpower facility in Wyoming; hence, no regionally specific data on potential waterfowl, shorebird, and wader mortality are available. No regional data are available for population structures of these groups within the KPPA, so potential population impacts are based on speculation. The KPPA provides little nesting or foraging habitat for these species, and their use of the area is primarily incidental or during migration; therefore, impacts would probably not be significant. However, mountain plover, a candidate species for federal T&E listing, nest on top of Foote Creek Rim where turbines would be placed. Adult mountain plovers and their chicks were frequently seen on the rim during the 1994 breeding season (Mariah 1994a). Section 4.2.4.3 includes a discussion of potential impacts of the proposed project on the mountain plover.

The flight behavior of waterfowl, shorebirds, and waders may make them susceptible to collisions with turbines. Many flight observations (45%) of these species were at rotor height (Section 3.2.2.5). However, on Foote Creek Rim, waterfowl and shorebird [except mountain plover (Sections 3.2.3.2 and 4.2.4.3)] use of the rim is limited to infrequent flyovers (less than 5% of non-raptor observations were of these types) (Mariah 1994a). The relationship between abundance, use and turbine-caused mortality has not been quantified for waterfowl and shorebirds, so impacts of the proposed development cannot be definitively stated. However, given the very low mortality of waterfowl and shorebirds at other Windplants, it is unlikely that common species will suffer biologically significant mortality.

The 230-kV transmission line and overhead collection and communications lines could also cause waterfowl, shorebird, and wader mortality within the Windplant. Estimated annual mortality rates (including passerines) from collisions with power lines for other parts of the U.S. range from 1.6 mortalities/mi (1.0 per km) of overhead wire

(Illinois) (Avery 1979) to 106 birds/mi (66.0/km) of power line during fall migration (Great Plains) (Faanes 1987). However, in the latter study, the estimated annual mortality rate doubled after accounting for scavenger removal of carcasses and observer error in locating carcasses. Goddard (1977) reported 54.0 mortalities/mi/year (33.6 mortalities/km/year) in Minnesota during spring and fall. Lower rates have been observed in central Michigan (<0.01 collision/year for gulls, 0.4 collision/year for blue-winged teal, 0.1 collision/year for American coot, and 20.5 collisions/year for great blue heron).

In the U.S., mortality of over 80 species of birds has been documented due to wire strikes or electrocutions. Migratory water birds such as grebes, pelicans, herons, ducks, cranes, and shorebirds were most frequently killed. Attractive habitat, weather, visibility, and flight behavior are among the factors affecting mortality (Table 4.16). Overhead ground wires apparently cause more mortality than overhead conductors, probably because ground wires are typically thinner and less visible than conductors (Beaulaurier et al. 1984; Faanes 1987; Lee 1978). In studies of power line avian mortality, 80 to 95% of deaths were attributed to collisions with overhead ground wires (Beaulaurier et al. 1984; Faanes 1987), and ground wire removal reduced mortality by approximately 50% (Beaulaurier et al. 1984). Since ground wire removal or burial is generally not feasible, ground wires may be marked (e.g., balls, spiral vibration dampeners) to improve visibility and reduce impacts to waterfowl, shorebirds, and waders. Although many waterbird species have been observed within or immediately adjacent to the KPPA, no mortality would occur due to electrocution because conductors would be spaced to prevent electrocution. Furthermore, preferred habitat for waterbirds is limited within the KPPA and is primarily restricted to riparian areas, which make up <1% of KPPA (Section 3.2.1.2).

Impacts due to power line collision would be mitigated by locating lines away from riparian areas or known foraging or nesting areas for these types of birds. Small wetlands within the KPPA would be avoided, where feasible. Impacts probably would be greatest where the 230-kV transmission line crosses the Medicine Bow River; all three alternate routes would cross the river, but the riparian area is much wider where Alternate 1 crosses compared with Alternates 2 or 3.

Indirect impacts (i.e., loss of foraging or nesting habitat, displacement) would be negligible because little habitat for waterfowl, shorebirds, and wading birds occurs within the KPPA.

Under the Proposed Action, waterfowl, shorebird, and wader mortality would probably be relatively low due to their low numbers and incidental use of the KPPA. Mortality is unlikely to have a significant effect on populations, unless individuals of T&E species are killed. Impacts on T&E bird species are discussed in Section 4.2.4.3. Waterfowl, shorebird, and wader mortality would be monitored beginning with the first phase of development (Appendix B), and appropriate mitigations would be developed and incorporated into PODs for subsequent phases as impacts on these groups are understood.

Alternative A. Under Alternative A, 40% fewer turbines and overhead collection and communications lines would be erected, and thus, potential for collisions with turbines would be reduced, although the amount of reduction would depend on turbine placement relative to flyways and foraging and nesting areas. Direct and indirect impacts are potentially significant. However, due to the low numbers of water birds using the KPPA, negligible LOP impacts to waterfowl, shorebird, or wader populations are expected (except see Section 4.2.4.3). Impacts due to transmission line construction would be the same as for the Proposed Action, and similar mitigation measures (i.e., locating the transmission line away from wetlands and riparian areas; marking overhead ground wires, where necessary), would be implemented. Mortality of these species would be monitored beginning with the first phase of development to further assess impacts and

Table 4.16 Factors that May Influence the Number of Bird Collisions with Transmission Lines.[1]

Bird biology	Factors Influencing Collisions
Species	Nocturnal fliers or those with awkward flight characteristics
Age	Immature birds with limited flight experience
Health	Sick or injured birds
Migration	Migrants, as opposed to resident birds
Sex	Birds involved in courtship displays
Flight	
Flight intensity	Large numbers of birds crossing the ROW during all times of day
Flight height	Flight heights equal to or lower than the uppermost wires
Size of flocks	Large dense flocks with little space between birds
Time of flocks	Nocturnal and diurnal flights during inclement weather
Transmission line	
Tower type	Guyed structures or tall towers near river crossings
Voltage	Lower voltage lines with reduced electric field and corona effects
Conductor characteristics	Small diameter, single conductor/phase configurations
Number of lines	Double-circuit lines with wire at different heights
Overhead ground wire	Multiple wires small in diameter compared with conductors
Line length	A long line through a high-use area
Age of line	A newly constructed line to which birds have not habituated
Aircraft warning light	Nonflashing lights on towers in established flyways
Environment	
Weather	Fog, snow, rain, sleet, or high winds
Habitat	Attractive bird habitat on and surrounding the ROW
Human activity	Hunting and other human activities that startle or distract birds; other developments in adjacent areas that may displace birds onto proposed site
Geographic location	Lines located perpendicular to a narrow, low-altitude flyway

[1] From Lee (1978).

develop appropriate mitigation measures for subsequent phases.

No Action. Under the No Action Alternative, no impact to waterfowl, shorebirds, or waders would occur due to Windplant development.

Cumulative Impacts. Cumulative impacts to waterfowl, shorebirds, and waders probably would be greatest during migration seasons when large numbers of migrating birds encounter power lines or other developments in flyways. Power lines near riparian areas would cause the greatest mortality because these types of birds would be taking off, landing, and concentrating in these areas. Because there is little riparian habitat within southern Wyoming, individual wetlands may be an important oasis for migrating birds. There are currently few power lines crossing waterways (e.g., the North Platte and Green Rivers, Seminoe Reservoir), so migrating or resident birds would have sufficient alternate suitable habitat, if power lines across waterways on the KPPA made this habitat unsuitable. Alternatively, placement of power lines across waterways may not cause water birds to avoid these areas, and continued use may increase avian mortality due to collisions with power lines.

Other types of development (e.g., oil and gas, coal, urban) probably cause some mortality and displacement of waterfowl, shorebirds, and waders. Because local population dynamics are not known, cumulative impacts from these developments cannot be definitely quantified. Cumulative impacts (direct and indirect) probably would be negligible due to the lack of extensive waterfowl, shorebird, and wader concentration areas among these developments.

4.2.3.7 Passerines

Significance Criteria. Impacts to passerines would be considered significant if project-related activities resulted in violation of the MBTA (16 U.S.C. 703-711) or declining passerine populations.

Proposed Action. The primary impact to passerines under the Proposed Action would be turbine-caused mortality. Indirect impacts (e.g., displacement, loss of habitat) also could lead to population declines; therefore, impacts to passerines are potentially significant.

Passerine mortality has occurred at Windplants in the U.S. and abroad. At a single large turbine located on the coast of Denmark, seven non-raptor carcasses (including passerines and waterfowl) were recovered during a two-year study (Pedersen and Poulsen 1991), and no mortality was observed during a survey of mid-sized turbines [33-98 ft (10-30 m) towers, 23-82 ft (7-25 m) rotors] (Winkelman 1985). Numbers of passerines recovered annually from Windplants in California ranged from 1 to 26, with the most (26) recovered at Altamont Pass, where 1,169 turbines were sampled (Howell and Noone 1992, Orloff and Flannery 1992). However, the California studies concentrated on raptor mortality, and may have missed small passerine carcasses. Twenty-five passerine carcasses were recovered from the two turbines at Medicine Bow, Wyoming (Yeo et al. 1984). Avian collisions with man-made structures account for an estimated 5 to 80 million mortalities annually (Avery 1979, Jaroslow 1979). Most deaths are caused by collisions with vehicles, overhead power lines, towers, and other tall structures (Avery 1979, Banks 1979, Cassel et al. 1979, Beaulaurier et al. 1984, Faanes 1987).

Many researchers have concluded that turbine-caused mortality for passerines is not biologically significant, based on low passerine mortality rates and presumed large passerine populations (Howell and DiDonato 1991, Howell et. al 1991b, Orloff and Flannery 1992). However, passerine carcasses are difficult to locate during mortality surveys due to their small size and other factors (e.g., scavenging by predators, searcher efficiency, etc.); therefore, passerine mortality may be greater than reported.

Potential passerine mortality is difficult to quantify because the proposed Windplant would be the first industrial scale windpower facility in Wyoming.

Furthermore, passerine population status within the KPPA is unknown, so speculation about potential impacts to passerines must be based on regional Breeding Bird Survey data. Breeding Bird Survey data have several limitations that make speculation about passerine population trends tenuous. The biggest limitation is that point counts are conducted along roads, so rare birds and birds of locally distributed habitats poorly represented by roads are undersampled (Robbins et al. 1993). The horned lark was, by far, the most commonly seen passerine within the KPPA (Mariah 1994a), and this species is listed as an abundant resident throughout southern Wyoming (WGFD 1992). However, according to Breeding Bird Survey data compiled by the USFWS, horned lark populations have experienced significant declines in the western U.S., as well as in Wyoming, for the past two decades (Cerovski et al. 1993). Horned lark numbers have also been declining in the Wyoming Basin, the physiographic region where the proposed Windplant is located, but the decrease has not been significant (Cerovski et al. 1993).

The five other most commonly seen passerines within the KPPA in order of abundance were the mountain bluebird, cliff swallow, Brewer's blackbird, vesper sparrow, and green-tailed towhee (Section 3.2.2.6) (Mariah 1994a). Cerovski et al. (1993) reported that cliff swallow populations have been increasing in the western U.S., Wyoming, and the Wyoming Basin. The Brewer's blackbird population has remained relatively stable, experiencing a slight decrease in the Wyoming Basin. Green-tailed towhee populations slightly increased in the state, while they decreased 9.5% (a non-significant decline) in the Wyoming Basin. Vesper sparrow numbers decreased in Wyoming in the last ten years, but significantly increased (8.4%) in the Wyoming Basin. Finally, the mountain bluebird experienced a slight decrease in population size in Wyoming in the last ten years, but numbers significantly increased (7.6%) in the Wyoming Basin (Cerovski et al. 1993). Population trends for western neotropical migrants were also reported for Wyoming in Carter and Barker (1993). Their conclusions are comparable to Cerovski et al. (1993): horned lark populations are declining, cliff swallow, mountain bluebird, and vesper sparrow populations are increasing, and there are not enough data to determine the population trend for the Brewer's blackbird or green-tailed towhee.

Given the large number of passerines seen on the KPPA in 1994 (over 9,000 passerine observations recorded during seven months of weekly surveys on Foote Creek Rim) (Mariah 1994a), passerine mortality is likely to occur under the Proposed Action, although turbine-caused mortality rates are unknown for any one species. Because any mortality would be a violation of the MBTA (unless limited take is permitted by the USFWS), the impact would be significant. Mortalities may be reduced by avoiding placement of WTGs in high use areas (Figure 3.4). Flight behavior of passerines would also probably lead to a lower turbine-caused mortality for these species compared to raptors or waterfowl. A small percentage (11-16%) of passerines were observed flying at rotor height on Foote Creek Rim; most were observed flying below rotor height (Table 3.17). However, passerines may fly higher during migration, and mortality rates may temporarily increase during spring and fall (personal communication, November 1994, with Linda Kerley, University of Wyoming Cooperative Unit).

If turbine-caused passerine mortality rates are low, the impacts to passerine populations probably would not be biologically significant. Although precise passerine population data are lacking, broad-based regional data suggest the most commonly seen passerines, with the exception of horned larks, within the KPPA generally have healthy populations; if current trends continue, impacts to most populations would probably be negligible for the LOP. While horned larks seem abundant, populations have been declining for the last 20 years (Cerovski et al. 1993), and additive mortality caused by wind turbines could lead to further population decline, which would be a significant impact. Passerine mortality would be monitored beginning with the first phase of development (Appendix B), and appropriate mitigations would be developed and incorporated into PODs for subsequent phases as impacts to passerine populations are understood.

In addition to mortality caused by turbines, the 230-kV transmission line and overhead collection and communications lines could also cause passerine mortality within the KPPA (see Section 4.2.3.6 for a discussion of avian deaths caused by electrocution and potential impacts to populations).

Under the Proposed Action, impacts to passerines would be significant because the MBTA would be violated when passerines are killed by collisions with turbines, unless a special purpose permit or other authorization is obtained from the USFWS. Impacts to horned larks would be potentially significant. Probability of turbine collision is low for passerines because most of these species were observed flying below turbine rotor height. Therefore, although Brewer's blackbird and green-tailed towhee populations are declining regionally, impacts to these populations would probably be negligible.

Alternative A. Under Alternative A, impacts to passerines would be potentially significant. Alternative A impacts the same area as the Proposed Action, but would have 40% fewer turbines. Impacts to passerines under Alternative A probably would be less, but may not be reduced by 40% because factors such as turbine characteristics and placement would influence mortality rates. As with the Proposed Action, the monitoring program would measure passerine mortality and identify appropriate mitigation measures.

No Action. Under the No Action Alternative, no impact to passerines due to Windplant development would occur.

Cumulative Impacts. Lack of data quantifying the status of local passerine populations and impacts of other disturbances in the area make assessment of cumulative impacts tenuous. However, most common species sampled with Breeding Bird Survey techniques appear to have stable or increasing populations (Cervoski et al. 1993). The population trends of uncommon or rare passerines remain unknown. Although collision probabilities are not known for Wyoming, low mortality rates comparable to those recorded at other Windplants are anticipated for the Proposed Action. Given large regional passerine populations (Cervoski et al. 1993) and anticipated low collision rates, cumulative impacts of the Proposed Action are not expected to be biologically significant. Horned lark populations may be significantly impacted over time if this species has high turbine-caused mortality that contributes to additional decline in an already declining population. Mortality rates of horned larks and all passerines will be monitored to determine the significance of impacts of the Proposed Action to passerine populations. During monitoring, cumulative impacts of the Proposed Action would be viewed on a regional scale for passerine populations, if necessary.

4.2.3.8 Amphibians and Reptiles

Significance Criteria. Quantifiable criteria that specifically define that level at which disturbance to amphibian and reptile habitats becomes a significant impact to population health are not described in the literature or by regulatory agencies. For this EIS, impacts to amphibian and reptiles would be considered significant if project activities result in a decline in populations of these species.

Proposed Action. While amphibians and reptiles would be negatively affected by increased human activity in the KPPA, primary effects would occur in direct proportion to the amount of potential habitat removed by project construction. Approximately 319 ac of potential habitat would be disturbed due to Phase I construction, which represents approximately 0.5% of potential habitat within the KPPA. Construction of the 500-MW Windplant would disturb approximately 1,787 ac of potential amphibian and reptile habitat, or about 3% of the KPPA. Overall impacts to amphibian and reptile populations within the KPPA would likely be negligible due to the relatively low density of amphibian and reptile species within the

KPPA combined with the scattered distribution and extent of potential disturbance. Rare or important habitats (e.g., wetlands) would be avoided during Windplant construction, further reducing impacts to amphibian populations in the KPPA. A slight increase in amphibian and reptile mortality would initially occur due to Phase I and the 500-MW Windplant construction, and would remain slightly elevated for the LOP due to increased traffic; this impact to populations would also be negligible.

Alternative A. Impacts to habitats used by amphibians and reptiles under this alternative would decrease by about 40% from levels identified for the Proposed Action. Therefore, impact levels would likely remain negligible.

No Action. No impact would occur to amphibian and reptile populations within the KPPA under the No Action Alternative.

Cumulative Impacts. Regional cumulative impacts to amphibian and reptile habitat include mines (i.e., approximately 22,598 ac of disturbance, 5,741 ac of which is active at any one time), oil and gas development, and roads (e.g., federal and state highways, primary and secondary roads). The majority of this disturbance is scattered throughout the region, and presents a negligible impact to amphibian and reptile populations. Maximum cumulative disturbance within the KPPA (i.e., construction of the 500-MW Windplant and existing disturbance) would total 2,226 ac, or 3.7% of the potential amphibian and reptile habitat within the KPPA. With the avoidance of wetlands during Windplant construction and other habitat protection measures (see Section 5.1.3.10), cumulative impacts to amphibian and reptile populations within the region are expected to be negligible.

4.2.3.9 Fisheries

Significance Criteria. Impacts to fisheries would be considered significant if project-related activities resulted in the degradation of any surface water such that its WGFD Stream Classification (WGFD 1991) would be permanently reduced.

Proposed Action. Although unlikely, initial construction activities may degrade water quality due to increased sedimentation and runoff. This potential impact probably would be negligible with the implementation of proper erosion control mitigations (see Sections 5.1.3.6-5.1.3.7) and would remain negligible throughout the LOP. In addition, the distance of disturbance from fisheries and avoidance of wetland areas would further minimize potential fisheries impacts.

Alternative A. Since the total area of disturbance would be less than that for the 500-MW Windplant and the same mitigation measures would be applied, impacts to fisheries under Alternative A would likely remain negligible for the LOP.

No Action. No additional impacts beyond existing levels would occur to fisheries under the No Action Alternative, since no additional development would occur.

Cumulative Impacts. Since all regional development projects (e.g., oil and gas development, surface mines) seek to employ proper erosion control and construction techniques, cumulative impacts to fisheries would likely be moderate. Some water quality degradation may occur as a result of water runoff from such large-scale disturbances as surface mines; however, mines employ sediment control structures to reduce potential impacts to water quality.

4.2.4 Threatened/Endangered, Candidate, and State Sensitive Species

4.2.4.1 Significance Criteria

Impacts to TEC&S species would be significant if: 1) any individual was taken (see Section 4.2.3.3 for details); and/or 2) their critical habitat was disturbed or destroyed such that the likelihood of survival or recovery of the species would be appreciably reduced.

4.2.4.2 Mammals

Black-footed Ferret. No significant adverse impact to the BBF is anticipated due to the proposed project because of the current lack of ferret populations in the KPPA and the limited amount of prairie dog colonies that would be disturbed by the construction of the Windplant and transmission lines. If BBFs are discovered in the KPPA, the USFWS, WGFD, and BLM would be consulted to determine the specific procedures necessary to protect the animals under the guidelines established for the reintroduced experimental population. BBF clearance surveys may be conducted [according to guidelines presented in USFWS (1989)] if BBFs are discovered within the KPPA and if sufficient potential ferret habitat would be disturbed in subsequent phases of the project. The BBF is the only federally designated T&E mammal for which potential habitat is present, or which has been reported, in or near the KPPA. The KPPA is within the area declared ferret-free prior to the reintroduction of ferrets in the Shirley Basin, and no ferret sightings have been confirmed in the KPPA since the reintroduction. It is unlikely that BBFs are currently present, but prairie dog colonies occurring throughout the KPPA provide potential habitat for the species.

Approximately 35% of the Simpson Ridge area is classified as BBF PMZ 2. Movements outside of the Shirley Basin PMZ 1 reintroduction site are anticipated as the ferrets become established and disperse. Three historic prairie dog colonies encompass approximately 979 ac (20%) (only a portion of which was active in 1994) of the Foote Creek Rim area and approximately 6.0 mi (9.7 km) of historic prairie dog colonies are crossed by Alternate 3. Alternates 1 and 2 also cross prairie dog colonies, the extent of which has not been field mapped. Approximately 34 ac of prairie dog colony will be disturbed by roads and WTGs on the Foote Creek Rim area. The amount of prairie dog colony that will be disturbed in the Simpson Ridge area will depend on the number of WTGs and roads that would be placed in prairie dog colonies, which has not been determined at this time. The transmission line will cross prairie dog colonies, but the surface will not be bladed, staging areas will be placed outside of prairie dog colonies, and the only subsurface disturbance will be the holes dug for the poles. Antiperching devices for raptors will be installed on transmission line poles within prairie dog colonies in the PMZ to eliminate perching opportunities for raptors that might prey on BBFs.

Alternative A would have no significant adverse impact to the BBF due to the same reasons given above for the Proposed Action. There would be 40% less area disturbed under Alternative A, which may decrease the potential for disturbing prairie dog colonies; however, the disturbance locations on the Simpson Ridge area have not been determined and it is likely that the reduced number of WTGs would reduce prairie dog colony disturbance by something other than 40%, depending on WTG placement. The No Action Alternative would have no impact on the BBF. The proposed project would have only negligible additional impacts, if any, to the cumulative effects on BBF habitat from ranching, mining, oil and gas projects, and transportation; and on prairie dogs from pest control and recreational shooting.

Other Mammals. Of the three C2 mammals that are of concern, both the long-legged myotis and the swift fox are provided with potential habitat on the KPPA. Potential habitat for the North American lynx is not present on the KPPA, and this mammal may occur only very rarely within the area (i.e., vagrant individuals). Therefore the lynx would not be impacted by the proposed project or alternatives. Long-legged myotis have not been observed within the KPPA, but are potential visitors to the area. The foraging flights of this species are direct and rapid, and often at treetop height (Clark and Stromberg 1987); therefore, these bats could be subject to turbine mortality. Overall, however, the likelihood of collision is probably slight, and the species would not be adversely impacted by Windplant development.

Swift fox have not been reported in the KPPA, but grassland habitats within the area could be used by the species. Disturbance of grassland types would reduce potential habitat; however, impacts of the proposed project or Alternative A would be negligible due to this species' infrequent use of the area.

The state sensitive mammals that have been reported near, but not in, the areas proposed for WTGs are white-footed mouse and hoary bat. White-footed mice inhabit deciduous woodlands and associated riparian areas, and the only disturbance in those habitats would be associated with the transmission line. Transmission line disturbance will be minimized in these habitats, and impacts to the white-footed mouse, if they occur at all, are expected to be negligible. Hoary bats may occur in the KPPA during the summer, and the potential for them to collide with turbine rotors is present; the probability of such collisions is unknown, but anticipated to be low given the bat's ability to locate and respond to both stationary and moving objects. Hoary bat populations are secure globally (WNDD 1991), and any impacts of the proposed project or alternatives are expected to be negligible.

Overall, the Proposed Action or Alternative A would be expected to cause negligible additions to the cumulative effects on these candidate and state sensitive species from ranching, mining, oil and gas projects, transportation, and recreational activities in the region.

4.2.4.3 Birds

Endangered Species

Of the three endangered bird species identified as potentially present in the project area by the USFWS, two (bald eagle and peregrine falcon) have been observed. Whooping cranes could incidentally migrate through the KPPA, but none have been reported, and the KPPA is outside of the area they normally use during migration. Therefore, the Proposed Action and alternatives are not expected to have any impact on whooping cranes.

Bald Eagle. No bald eagle nests were located within the KPPA during the 1994 nest survey; however, one active nest was located approximately 2.0 mi (3.2 km) south of the Simpson Ridge area, and bald eagles have been observed using both the Foote Creek Rim and Simpson areas (Section 3.2.3.2). No specific winter roost sites have been identified within or immediately adjacent to the KPPA, but cottonwood trees along the Medicine Bow River, Rock Creek, and other drainages are regularly used as perches. Because there is potential for bald eagle mortality, impacts from Windplant development under the Proposed Action or Alternative A are potentially significant.

Bald eagles react to human disturbance by flying away from the source of disturbance and avoiding areas of intense human activity (Vian 1971, Stalmaster and Newman 1978, Steenhof 1978). The closest distance that bald eagles will tolerate human activities is variable and depends on numerous factors, including age, presence of food, and habituation to activity. Bald eagles appear to habituate to routine human activity (Edwards 1969, Grier 1969, Stalmaster and Newman 1978). Stalmaster and Newman (1978) report that buffer zones of 820 ft (250 m) would protect 99% of the wintering bald eagle population from disturbance in open regions where human activities are common. When there is no human activity, bald eagles readily approach man-made structures (Vian 1971). An initial surface disturbance of 319 ac during Phase I and 1,787 ac for the 500-MW Windplant (715 ac for the LOP) combined with the presence of facilities and humans will reduce the amount of foraging habitat available to bald eagles. These birds forage widely during winter and seek concentrated food sources (e.g., fisheries and waterfowl conservation areas) and areas with high lagomorph populations. They are opportunistic scavengers of domestic livestock and big game carcasses. The KPPA has not been identified as critical habitat for the bald eagle. The amount of foraging habitat disturbed by the proposed project or Alternative A (approximately 40% less) would likely have a negligible adverse impact on prey and foraging opportunities available to bald eagles using the KPPA and surrounding region.

Mortality or injury is the primary potential impact on bald eagles that may occur as a result of the proposed project. Bald eagle mortality has been reported from both electrocution and impacts with power lines (Coon et. al. 1970, Vian 1971). Mortality through electrocution is not expected to be a problem with the proposed project because the overhead collection and transmission lines will be designed and constructed as recommended in Olendorff et al. (1981) and wildlife boots will be placed on other electrical facilities to reduce the chances of electrocution. Instead, mortality or injury will more likely be due to collisions with either power lines or WTGs. Although bald eagles were observed on windfarms in California, no bald eagle carcasses have been recovered from these windfarms (Howell and Noone 1992, Orloff and Flannery 1992). Hence, data on which to base a quantitative estimate of numbers of bald eagles killed on the KPPA (i.e., similar to estimates given for some other raptor species in Section 4.2.3.4) is lacking. However, given the year-round presence of bald eagles of all age classes in the KPPA, combined with the number of WTGs and amount of new power line, mortality due to collision is likely during the LOP. Mortality of even one bald eagle would be a significant adverse impact. If annual bald eagle mortality were equivalent to the estimated mortality of 3 to 15 golden eagles (which are much more abundant than bald eagles on the KPPA), there would be a significant adverse impact to the population of bald eagles using the KPPA. Bald eagle mortality will be monitored to determine the number killed, if any.

The No Action Alternative would have no impact on bald eagles.

Cumulative impacts to the regional bald eagle population may be potentially significant. Impacts resulting from such developments as surface mining, oil and gas development, urban developments, and roads are generally negligible; some foraging habitat is removed, but large areas remain available to eagles. Also, all developments (including the proposed Windplant) avoid winter roosts and active nests, further minimizing disturbance to the species. Direct mortality resulting from WTGs on the proposed Windplant would present the largest source of impact to the regional bald eagle population; the significance of this impact is dependent upon the number of actual collision mortalities occurring over the LOP.

Peregrine Falcon. No peregrine falcon nests were located on or near the KPPA in 1994, and there is a minimal amount of suitable nesting habitat (i.e., tall cliffs) available in the area. Therefore, neither the Proposed Action or the alternatives are likely to impact peregrine falcon nesting or breeding activity. Peregrine falcons have occasionally been observed in the KPPA (Section 3.2.3.2), so there is the potential of adverse impacts due to disturbance of foraging habitat or mortality in a manner similar to that described for bald eagles. Although peregrines may be relatively sensitive to human presence, they exhibit wide variation in their response to humans, with some even residing and nesting in major metropolitan areas. The impact due to habitat loss through removal of vegetation and human presence would be negligible given the occasional use of the area by peregrine falcons and the presence of other large, undisturbed areas that will remain within the KPPA and surrounding region. As with bald eagles, mortality due to electrocution is unlikely; there is, however, the potential for mortality due to collisions. Falcons may be more susceptible to collisions than bald eagles due to their hunting behavior. Twenty-one of 27 (78%) peregrine falcons observed in the Foote Creek Rim area during 1994 surveys were flying within the range of the rotor blades [i.e., 26-184 ft (8-56 m)] (Mariah 1994a). In addition, falcons focus on flying prey and may not pay attention to potential hazards in the vicinity of the hunt. As was discussed previously for other raptors (including bald eagles), it is difficult to estimate the amount of mortality that may take place due to the

Proposed Action or Alternative A; however, any mortality of peregrine falcons would be a significant impact due to the endangered status of the species.

The No Action Alternative would have no impact on peregrine falcons.

Cumulative impacts to the regional peregrine falcon population would be similar to that described for the bald eagle (i.e., potentially significant). The proposed Windplant may be the largest source of direct mortality to peregrine falcons in the area; any mortality to this species would be considered a significant impact.

Candidate Species

Bird species that are candidates for T&E listing and have the highest potential to be impacted by the proposed project are mountain plover, ferruginous hawk, and loggerhead shrike; each is discussed below. Other candidate species known to occur or potentially occurring on or adjacent to the KPPA (i.e., Baird's sparrow, long-billed curlew, northern goshawk, western burrowing owl, western snowy plover, trumpeter swan, and white-faced ibis) have only been infrequently reported, and impacts to these species due to the proposed project are expected to be negligible. While the presence of WTGs and transmission lines in areas where these candidate bird species may occasionally fly creates a risk for collision mortality, the probability of such mortality is very low due to the infrequency of these flights through the area.

Given the safeguards that will be built in to the proposed project to prevent electrocution, impacts due to electrocution mortality probably would be negligible and are not discussed individually below. Potential impacts on candidate species within the KPPA are habitat loss due to disturbance and human presence and turbine collision mortality.

Mountain Plover. Mountain plovers were routinely reported (234 observations) on Foote Creek Rim during spring and summer in 1994 (Mariah 1994a). Mountain plovers also nest on the rim; one nest was discovered, and most observations in mid-summer were of adults with chicks. A rough estimate indicates that from 15 to 20 breeding pairs were present on the portion of Foote Creek Rim surveyed during 1994 (see Figure 3.4 for survey point locations). Because loss of mountain plover breeding habitat may be one of the causes for population declines, impacts to mountain plovers from the first phase of development and any future development on the Foote Creek Rim area probably would be significant. Mountain plovers were not recorded in the Simpson Ridge area, but potential habitat is present and 1994 Simpson Ridge surveys were limited to points along Highway 72 and several unimproved roads (Appendix A). Impacts from development on the Simpson Ridge area are potentially significant.

Mountain plover mortality due to collisions with WTG towers or rotors is a potential impact, but the low flight behavior characteristic of the species will likely reduce opportunities to collide with the rotors. Other than during migration, only during breeding and nesting periods do mountain plovers fly more than a few feet off the ground (Graul 1975; Terres 1980). In the "falling leaf" courtship display as described by Graul (1973), male (and occasionally female) mountain plovers fly to a height of 15 to 30 ft (5 to 9 m), hold their wings in a deep "V" position, and float slowly to the ground. The lower reaches of the turbine rotors and the upper limits of the courtship display overlap for a few feet. Approximately 3 of 13 (23%) mountain plover flight heights observed on Foote Creek Rim during 1994 were recorded within the range of the rotor blades [i.e., 26-184 ft (8-56 m)]. Although there is only a limited potential for mountain plover mortality, any mortality of this rare species would be considered significant.

Loss of mountain plover breeding habitat will occur due to disturbance of vegetation and presence of humans. Loss of habitat in the breeding range is suspected as one of the primary causes for long-term population declines (Wiens and Dyer 1975). Studies and survey data show the mountain plover to be generally tolerant of disturbance, and a radius of disturbance from human activity of 656 ft (200 m) was established based on data from Colorado in 1992 and input from mountain plover researchers (USFS 1994b). Incubation and brooding, which takes place between April and July, are critical periods when disturbance can adversely impact mountain plovers. A bird off the nest for more than an estimated 15 min during incubation, or separated from young for more than 15 min during brooding, may result in the egg not hatching or death of chicks, especially during temperature extremes (USFS 1994b). Using the 656-ft (200-m) distance from human activity as an estimate of reduced habitat effectiveness, potential nesting habitat lost on the Foote Creek Rim area during Phase I would be approximately 1,229 ac (25% of the Foote Creek Rim area) initially and 1,032 ac (21%) for the LOP; full development of the rim would impact approximately 3,241 ac (65%) initially and 3,022 ac (60%) for the LOP. This loss of habitat may be even greater if snowdrifts caused by Windplant facilities persist throughout the spring, when mountain plovers return to the rim and start breeding.

Potential mountain plover habitat on the Simpson Ridge area is less common than on Foote Creek Rim. Although the locations of disturbance within the Simpson Ridge area are not currently known, it is unlikely that all disturbed areas will be potential habitat. In a worst-case scenario for the 500-MW Windplant (i.e., that all disturbance would occur in mountain plover habitat), approximately 8,178 ac (14% of the KPPA) would be initially impacted and 7,654 ac (13%) would remain impacted for the LOP. Figures for Alternative A would reduce this to approximately 4,907 ac (8%) initially and 4,592 ac (8%) for the LOP.

Given the number of mountain plovers that use Foote Creek Rim, the amount of suitable nesting habitat that may be rendered unusable due to project activities, and the fact that the species will very likely be listed as threatened or endangered in the near future, impacts due to the reduction in habitat on the Foote Creek Rim area would be considered significant. The worst case for full development on Simpson Ridge would also be a significant impact; however, this worst-case scenario is not likely, and potential impacts may be reduced to moderate levels given the likelihood that much of the Windplant will be placed on sites that are not potential habitat for mountain plovers.

The No Action Alternative would have no impact on the mountain plover.

Cumulative impacts to the local mountain plover population would be potentially significant. Disturbance due to surface mining, oil and gas development, urban developments, and roads has removed an unknown portion of potential mountain plover nesting habitat. Additional disturbance associated with human activity in and around these sites has increased the overall area affected by these developments. Therefore, existing past and present disturbance within the region surrounding the KPPA may already constitute a significant impact to the local mountain plover population. Surface disturbance resulting from proposed WTGs and roads along Foote Creek Rim would add to this existing, potentially significant loss of mountain plover nesting habitat.

Ferruginous Hawk. Ferruginous hawks are common in the KPPA and frequently fly along the western edge of Foote Creek Rim (Section 3.2.3.2). Seventeen of the 97 ferruginous hawk nests in the 1994 raptor nest survey area were active during 1994. Avoiding physical disturbance of nests or nest substrates, as well as adherence to stipulations prohibiting disturbance of active nests and associated buffer zones, would ensure that only negligible impacts to ferruginous hawk nesting habitat result from the Proposed Action. As is the case with other raptor species within the KPPA, the primary impacts to ferruginous hawks would be habitat disturbance in foraging areas, human presence, and mortality due to collisions; all of these impacts are potentially significant.

The entire KPPA is potential foraging habitat for ferruginous hawks. Surface disturbance and presence of facilities on the Foote Creek Rim area during Phase I would initially remove approximately 319 ac (68 ac for the LOP); development of the 500-MW Windplant would initially affect 1,787 ac (715 ac for the LOP). The amount of habitat disturbed under Alternative A would be approximately 40% less. Ferruginous hawks avoid areas in close proximity to human activity; the presence workers will temporarily reduce the availability of adjacent foraging habitat on a localized basis. Ferruginous hawks do not avoid areas immediately adjacent to man-made structures if humans are not present, and even build nests on active oil or gas field facilities in the region (personal communication, January 1992, with Bob Tigner, Planning and Environmental Specialist, BLM). The relatively small amount of area disturbed by the Proposed Action or Alternative A would not be a significant adverse impact on ferruginous hawks given the amount of undisturbed habitat available throughout and adjacent to the KPPA.

Mortality due to collisions with WTGs is the most likely potential impact on ferruginous hawks. Based on mortality rates reported from California, estimated ferruginous hawk mortality would be approximately 0.201 birds per year for Phase I and 1.390 birds per year for the full project (Section 4.2.3.4). This mortality estimate may be low given the differences in ferruginous hawk abundance and seasonal use between California and Wyoming (Section 4.2.3.4). On the other hand, use of tubular towers reduces raptor perching opportunities, so ferruginous hawks may not be as likely to be in close proximity to rotor blades in the Wyoming Windplant (i.e., mortality due to collisions may be reduced). Although not currently listed as federally threatened or endangered, any mortality of ferruginous hawks would be considered a significant impact; however, the impact on the local population may not be biologically significant if the population is panmictic (Section 4.2.3.4).

There would be no impact to ferruginous hawks under the No Action Alternative.

As with bald eagles and peregrine falcons, cumulative impacts to the regional ferruginous hawk population would be potentially significant due to direct mortality associated with the proposed WTGs. Although a small portion of potential foraging and nesting habitat for ferruginous hawk has been removed through all past and existing developments (e.g., surface mining, oil and gas development), this would represent only a moderate impact to hawk populations; a majority of this habitat remains undisturbed and available to ferruginous hawks. Any loss of this species due to project-related mortality would be considered a significant impact.

Loggerhead Shrike. Loggerhead shrikes have occasionally been observed along the eastern edge of Foote Creek Rim in areas of sagebrush-grassland interspersed with trees and large shrubs; potential nesting habitat is scattered throughout the KPPA where large shrubs and trees occur adjacent to open areas.

Since it is likely that only a small amount of potential shrike nesting habitat will be disturbed by the proposed project or Alternative A, impacts to loggerhead shrike due to habitat disturbance and human presence would be negligible. Impacts to shrike foraging habitat under Phase I (319 ac or 0.5% of the KPPA), 500-MW Windplant (1,787 ac or 3.0% of the KPPA), or Alternative A (1,146 ac or 1.9% of the KPPA) would also be negligible; shrikes would probably shift their foraging activity to surrounding areas not impacted by the project. Mortality of shrikes due to collisions with WTGs is possible, but their relatively low number and scattered distribution in the KPPA would make this a rare occurrence; therefore, potential impacts to loggerhead shrikes due to collisions with WTGs would be negligible for the 500-MW Windplant or Alternative A.

There would be no impact to loggerhead shrikes under the No Action Alternative.

Because there is a relatively minimal amount of loggerhead shrike nesting habitat within the KPPA, existing and proposed disturbances (including the Windplant) would have a negligible cumulative impact on this species.

State Sensitive Species

Several state sensitive species have been observed or reported on or adjacent to the KPPA (Table 3.18). Four of these species (i.e., American white pelican, great blue heron, merlin, and upland sandpiper) have been observed frequently enough within the KPPA to merit a discussion of potential impacts of the Proposed Action or Alternative A.

The presence of WTGs and transmission lines in areas where these four species fly creates a risk of collision mortality. Mortality would be a significant impact due to legal considerations; population impacts are unknown because population dynamics for these species have not been studied.

Upland sandpiper habitat on the KPPA would be reduced due to physical disturbance and human presence in a manner similar to that described previously for other species. No upland sandpiper nests were found during avian surveys on the Foote Creek Rim or Simpson Ridge areas, although these areas could contain potential nesting habitat for this species. Upland sandpipers were observed in breeding displays on top of Foote Creek Rim in 1994 (Mariah 1994a). The impact of habitat reduction associated with Windplant development on upland sandpiper habitat would probably be moderate; if few sandpipers actually nest within areas to be developed, impacts to upland sandpiper habitat would be negligible. Habitats frequented by American white pelicans and great blue herons (i.e., wetland areas) and merlins (i.e., riparian zones) would not be avoided during Windplant development where feasible.

The No Action Alternative would have no impact on state sensitive bird species.

Overall, the negligible to potentially moderate (upland sandpiper) impacts on state sensitive bird species due to the proposed project would add a negligible amount to the cumulative impacts of other regional activities (e.g., ranching, oil and gas development, mining, transportation, recreation). Such a negligible increase is not expected to add to the potential significance of these cumulative impacts.

4.2.4.4 Amphibians and Reptiles

Wyoming Toad. Historic habitat for the endangered Wyoming toad is present in the Rock Creek drainage east of Foote Creek Rim; however, no toads are currently known to be present in the area. The Proposed Action and Alternative A would have no impact on the Wyoming toad, and would not add to the cumulative impacts due to other human activities that affect toads or their habitat.

Eastern Short-horned Lizard. This reptile species has been observed within the KPPA, and it is likely that much of the project area represents suitable habitat for the eastern short-horned lizard. Although some disturbance of areas containing short-horned lizards would likely occur during either the Proposed Action or Alternative A, overall loss of habitat for this species within the KPPA probably would be negligible (a maximum of 1,787 ac or 3% of the KPPA for the 500-MW Windplant). A slight increase in direct mortality of short-horned lizards would initially occur due to Windplant construction, and would remain slightly elevated for the LOP due to increased traffic; this impact to populations would also likely be negligible.

No impact would occur to this species under the No Action Alternative.

It is anticipated that the proposed project will not significantly increase existing and foreseeable cumulative impacts (e.g., oil and gas development, mining, recreation) to short-horned lizards and their habitat in the region.

4.2.4.5 Plants

The only federally listed species that may occur in the KPPA is the threatened Ute lady's tresses orchid, which is found in bogs, wetlands, and riparian or seepage areas. These habitats will be avoided during placement and construction of facilities, and statewide, the species has only been documented in Goshen County. No impact to this species is anticipated from the proposed project or alternatives; therefore, no increase in cumulative impacts to this species is anticipated.

Contracted Indian ricegrass, a C2 species, also potentially occurs within the KPPA; however, an initial plant survey of the Foote Creek Rim area in 1994 did not reveal its presence in the area (Mariah 1994a). Additional surveys for the plant would be conducted in areas to be disturbed by phases subsequent to Phase I of the project. If found in these areas, the BLM and USFWS would be consulted to determine appropriate avoidance and/or mitigation measures. Impacts to contracted Indian ricegrass from the proposed project and alternatives are expected to be negligible; these impacts are not expected to significantly add to the cumulative impacts of existing and foreseeable development in the region.

Moist hills, slopes, and woods, which provide potential habitat for slender-trumpet ipomopsis, a state sensitive species, occur on only a small portion of the KPPA east of Foote Creek Rim. No WTGs are proposed for this area, and no impacts to the species (either specific to this project or cumulative) are expected. The other state sensitive species potentially occurring within the KPPA, bun milk-vetch, is a plant of bare slopes and ridges. This species was observed near the northern end of the transmission lines in 1920. Construction activity in this habitat may disturb individual plants in localized areas, but the extent of such disturbance would be small relative to the total amount of habitat available. The impact of the proposed project and alternatives on bun milk-vetch populations is expected to be negligible. There would be no impact to this species under the No Action Alternative. Project-related impacts to the bun-milk vetch and its habitat are expected to be a negligible addition to the cumulative impact of other existing and foreseeable development.

4.3 CULTURAL AND HISTORIC RESOURCES

4.3.1 Significance Criteria

Significant impacts to cultural resources would be:

- loss or destruction of cultural resources which are eligible for or listed on the NRHP,
- failure to comply with BLM procedures implementing federal cultural resource management practices,
- any surface-disturbing activities within 0.25 mi (0.40 km) of significant historic roads and/or trails, unless such disturbance would not be visible from the trail or would occur in an existing visual intrusion area within the buffer, and
- disturbance through construction activities of important Native American traditional or cultural sites.

4.3.2 Proposed Action

The significance of the Foote Creek Rim Archaeological District to certain Native American tribes is currently being evaluated ("Foote Creek Rim Archaeological District" is a descriptive term encompassing all features on top of Foote Creek Rim; the term does not currently have regulatory meaning) (see Section 3.3). An ethnohistoric/ethnographic analysis of the area is being prepared under consultation with these tribes. Potential impacts to significant Native American ceremonial or traditional features will be identified during the study, but may be kept confidential due to the sensitive nature of this information. Because the consultations and impacts analysis are ongoing, a significance determination cannot be finalized at this time. However, significance determinations will be given in the FEIS.

Impacts to cultural resources from the Proposed Action could be direct or indirect. Direct impacts to cultural resources would be mitigated following procedures specified in 36 C.F.R. 800. Class I and Class III inventories have been conducted on portions of the Foote Creek Rim area, and would be conducted on all state and federal lands and on private lands affected by federal undertakings. All resources identified in Class III surveys would be evaluated for eligibility for the NRHP in consultation with the BLM and SHPO. Eligible or listed sites identified in the Class I and Class III inventories would be avoided, where feasible, as would areas with high potential for significant cultural deposits, such as sand dunes and alluvial terraces, where feasible. If any NRHP (eligible or listed) prehistoric sites found within the area cannot feasibly be avoided, a data recovery program would be implemented. Construction activities would be field checked as necessary by a qualified BLM archaeologist. If historic or prehistoric materials are discovered during construction, all activities within a 100-ft (31-m) radius of the site(s) would cease immediately, and appropriate BLM personnel would be notified by KENETECH or its subcontractors to assure proper handling of the discovery by qualified archaeologists.

Indirect impacts to cultural resources would be negligible since inventories and monitoring would locate most significant sites within and adjacent to road and power line ROWs. Potential impacts would be reduced through informing all personnel of the importance of the resources and the regulatory obligations to protect such resources. All personnel would be instructed that collection of cultural materials is prohibited. Historic trails and roads eligible for the NRHP would be avoided, where feasible, and no surface-disturbing activities would occur within 0.25 mi (0.40 km) of historic roads and/or trails, unless such disturbance would not be visible from the trail or would occur in an existing visual intrusion area within the buffer.

There are two reasonable scenarios of potential impacts to the Foote Creek Rim Archaeological District, although evaluation of the site and Native American consultations are on-going and new scenarios may arise as more information is obtained. First, the site could be considered eligible for the NRHP under Criterion D, which states that a cultural property must have, or have had, information to contribute to our understanding of human history or prehistory, and the information must be considered important, in which case physical avoidance of the features on the rim would be adequate mitigation.

Second, the features may be eligible for the NRHP under Criterion A. Properties can be eligible for the NRHP under Criterion A if they are associated with events or patterns of events that have made a significant contribution to the broad patterns of history. On Foote Creek Rim, features may be associated with Native American events involving their use of the area as a traditional cultural property (TCP). A TCP, in association with Criterion A requirements, may be eligible for inclusion on the NRHP because of its association with cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community. In order to achieve such significance, the property must retain integrity of setting (i.e., the physical environment of a property). Whereas location refers to the specific place where a property was built, setting refers to the *character* of the place in which the property played its historic role. Eligibility for the NRHP under Criterion A, and possibly as a TCP, is being evaluated during the ethnohistoric/ethnographic study of the site. If the district is determined to be eligible due to its significance to Native Americans, Windplant development could constitute a significant impact to the cultural resources on the Foote Creek Rim area. Mitigation for this impact would involve development of a mitigation plan. Options for the mitigation plan could be developed in consultation with the concerned Native American tribes.

Seventeen sites were recorded along Alternate 3. Three historic sites have been recommended as eligible, but a final determination will be made by the BLM in consultation with SHPO. These three sites, however, have the potential of being impacted by construction activities. The remaining 14 sites have been recommended as not eligible for inclusion on the NRHP and no impacts would occur to these cultural resources.

A 12-ft (4-m) segment of the 1868 UP Railroad grade (Site 48CR4328) could easily be spanned by the overhead transmission line, thereby eliminating all direct impacts to the site, however, a visual impact to the site may still be present. Mitigation of adverse impacts would be determined through consultation among the BLM, SHPO, and Advisory Council on Historic Preservation (ACHP).

Sites 48CR5755 and 48CR5772 are the Carbon Mine No. 7 and the UP Railroad Spur constructed to service the mine. Direct impacts to these sites would be avoided by placing the structures outside of the site boundaries.

There are no known potentially eligible sites along Alternates 1 and 2, but Class III surveys of these routes have not been completed. If either of these routes is selected in the ROD, a Class III survey would be completed prior to transmission line construction, and all eligible sites would be avoided, if feasible, or impacts mitigated. Because PacifiCorp has the capability to place structures away from sensitive resources, it is unlikely that any direct impact to cultural resources would occur from construction along these routes. Indirect visual impacts would occur, and thus, impacts would be moderate for the LOP and possibly beyond.

Beneficial impacts to cultural resources from the Proposed Action could include the discovery of important cultural resources during Class III surveys of proposed development areas.

4.3.3 Alternative A

Under Alternative A, impacts to cultural resources within the Foote Creek Rim Archaeological District would be similar to those for the Proposed Action because the first phase of Windplant development (70.5 MW) would occur on Foote Creek Rim. If the site is determined eligible for the NRHP under Criterion D only, impacts would be negligible for the LOP. If the district is determined eligible under other criteria as well as Criterion D, impacts would be significant for the LOP. Impacts associated with the remaining development would be reduced by approximately 40% from the Proposed Action because fewer WTGs and facilities would be erected and so there would be greater opportunity to avoid cultural resource sites. Impacts associated with transmission line construction would be the same as for the Proposed Action. Beneficial impacts resulting from the discovery of important cultural resources would be reduced by approximately 40%.

4.3.4 No Action

Under the No Action Alternative, no impact to cultural resources would occur. However, the potential to discover significant cultural resources during future Class III surveys of development areas would be lost.

4.3.5 Cumulative Impacts

Negative cumulative impacts of the numerous developments in southern Wyoming would include increased visitation by construction and survey crews to cultural resource sites and vandalism. Although these impacts can be mitigated, the adverse impacts would not occur in the absence of surface-disturbing projects. Because predisturbance surveys and mitigation are required for all developments, adverse cumulative impacts would be negligible.

Cumulative impacts to cultural resources are most often thought of in negative terms, since archaeological sites are non-renewable resources and any impact may adversely affect the total number of sites on the landscape. Furthermore, increased visitation from construction and survey crews and from the general public may lead to increased vandalism of archaeological sites. However, the scientific discovery of archaeological sites and the accumulated evidence of prehistoric social organization and subsistence strategies may, in fact, be beneficial cumulative impacts of development projects. Negative cumulative impacts may include the disturbance and/or loss of unidentified sites, features, or artifacts that could increase information about our heritage in the KPPA and throughout the region. If these cultural resources are not identified, inventoried, and/or appropriately protected prior to disturbance, then the cumulative loss of scientific information may irrevocably destroy the archaeological record.

If the Foote Creek Rim Archaeological District is eligible for the NRHP under Criterion A, then the cumulative impacts to the setting of the district from the Proposed Action and any future undertakings may be continually weakened to the point of loss of integrity of the setting. This would undermine the recommended eligibility determinations.

4.4 SOCIOECONOMICS

4.4.1 Significance Criteria

Impacts to socioeconomic features would be considered significant if project-related activities resulted in:

- population growth beyond the capacity of communities to provide adequate housing, schools, and services, or otherwise adapt to growth-related social and economic changes;
- revenue flows and expenditures by local, county, or state governments that are inadequate to maintain public services and facilities at established levels;
- any permanent displacement of residents or users of affected areas;
- perceived changes in existing ways of life resulting in community discontent sufficient to create organizational response and conflict; or
- a "boom and bust" cycle of employment and related economic growth and decline.

4.4.2 Proposed Action

4.4.2.1 Employment

Most employees would be hired locally for construction and operation of the Windplant; therefore, impacts to employment would be beneficial for the LOP. Windplant construction would occur from 1995 through 2004; PacifiCorp's transmission line construction would occur in 1995 only. For construction, 161 full-time employees would be hired during the second and third quarters of 1995 (Appendix E). Sixty person-days of dozer operator employment, for reclamation work, would be provided during the fourth quarter of 1995. Construction employment would decrease to 86 full-time construction employees hired for the second and third quarters of years 1996 through 2004. Eighteen trades would be needed for construction, including 46 laborers in 1995 and 30 during the years 1996 through 2004; other occupations would be in the construction, electric, and equipment operation fields.

O&M personnel (Windsmiths) would be employed throughout the LOP. Windsmith is a unique occupation created and trained by KENETECH. Starting at nine employees in 1995, the number of Windsmiths would increase gradually (by two or three additional employees each year) to 29 employees in 2004 (Appendix E). After the completion of construction, Windplant employment levels would remain at 29 employees during the years 2004 through 2034. Peak employment levels would occur during the second and third quarters of 1995 (when Phase I and transmission line construction are occurring), at a level of 170 employees.

The local labor pool in Carbon and Albany Counties would be primarily used to fill positions. A shortage of applicants exists for job classifications associated with transmission line construction and industrial electricians (Table 4.17). An adequate supply of applicants for most other fields is available. A large number of master electricians is available, especially construction electricians. These individuals would be used to fill many of the electrician positions and would be trained for the Windsmith positions.

Approximately 90% of Windplant employees would be drawn from the local labor pool. In-migrant workers would make up 10% of the labor force except when skills were in short supply locally (e.g., workers for transmission line construction). The number of in-migrant employees would range from one worker during the first quarter of 1995 to 47 in-migrants during the second and third quarters of 1995 (Table 4.18). The number of local hires would range from nine workers during the first quarter of 1995 to 123 local hires during the second and third quarters of 1995. After 2004, the proportion of local hires to in-migrants is projected to be 26:3.

Employment levels at the Windplant would represent less than 1% of total employment in Carbon and Albany Counties. Construction employment would be a short-term beneficial impact, and O&M employment would be a long-term benefit. The short-term employment of construction workers would have a impact on employment levels in the two counties during the last quarter of 1995 when construction workers from the Windplant begin to look for work elsewhere; but this impact would not be significant.

Construction payroll for the project would start at $3,169,285 in 1995, decrease to $1,760,635 in 1996 and gradually increase during the construction period to $2,409,548 in 2004 (Appendix E). The O&M payroll would start at $253,094 in 1995 and increase to $3,764,768 in 2034. Average second and third quarter construction salaries (six-month period) would range from $19,685 in 1995 to $28,018 in 2004. Average annual O&M salaries would range from $28,122 in 1995 to $129,820 in 2034. Total payroll paid during the LOP (1995 through 2034) is projected to be $96,102,427.

Local workers would be utilized to the maximum extent feasible. It is estimated that about 90% of employees would be current residents of Carbon and Albany Counties. Most employees would probably come from Rawlins, Hanna, Saratoga, Laramie, and other communities within 80 mi (128 km) of the Windplant. Job openings would be advertised locally through newspapers, Wyoming Job Service, and unions. Residents of Carbon and Albany Counties would receive hiring preferences.

Little long-term employment impacts would result from the proposed project. Jobs created by the Windplant would represent a small proportion of total employment in the region. No mitigation measures would be needed.

4.4.2.2 Population

Since the majority of Windplant employees (approximately 90%) would be residents of Carbon and Albany Counties, population in the region would change very little due to Windplant development; therefore, population impacts would be negligible for the LOP. Using an average household size of 2.1 persons, (assuming that many workers would not be accompanied by families), migration rates into the area would range from 99 during 1995 to 6 during years 2005 through 2034 (Table 4.19). Migration rates would be higher if KENETECH and PacifiCorp are unable to obtain sufficient numbers of employees from the local labor pool in the future. Because the level of population change that would be created by the Windplant is low, there would be negligible LOP impacts on the region's population as a result of the Proposed Action. No mitigation measures would be needed. Most in-migrants would probably move to Carbon County to avoid competition for housing with University of Wyoming students in Laramie (Table 4.20). Approximately 45% of in-migrants would be expected to move to the Rawlins area because of the current availability of housing in that community.

Table 4.17 Labor Availability Based on Job Applicants with Wyoming Department of Employment.[1]

Job Classification	Active Applicants on 8/31/94			Active Applicants 8/31/93 through 8/31/94		
Construction	Carbon County	Albany County	Total	Carbon County	Albany County	Total
Windplant						
Carpenter/form setter	1	1	2	4	3	7
Cement finisher	5	3	8	22	28	50
Cement, rebar	65	78	143	324	333	657
Electrician, helper	6	10	16	11	24	35
Electrician, industrial[2]	1	1	2	6	1	7
Electrician, master[3] (also eligible as Windsmith)	2	7	9	23	37	60
Laborer	34	16	50	169	56	225
Structural steel worker	1	1	2	10	5	15
Backhoe operator	10	1	11	43	2	45
Cherry picker operator	0	0	0	2	0	2
Cable crane operator	1	3	4	5	4	9
Dozer operator	7	1	8	41	2	43
Power shovel operator	10	1	11	43	2	45
Road roller operator	1	0	1	4	0	4
Transmission line						
Foreman	0	0	0	0	1	1
Lineman	0	0	0	1	0	1
Equipment operator	27	33	60	141	161	302
Laborer (see above)	-	-	-	-	-	-
Wireman	0	0	0	1	0	1
Operations						
Windsmith[4] (see also electrician, master)	0	0	0	3	0	3
Total	171	156	327	853	659	1512

[1] Wyoming Department of Employment, Employment Resources Division 1994.
[2] Based on applicants for electrician, maintenance; electrician, powerhouse (utilities); and electrician, substation (utilities).
[3] Based on applicants for electrician (construction); electrician supervisor (substation); and electrician supervisor (any industry).
[4] Based on applicants for load dispatcher and power plant operator. Electricians, master would also qualify as Windsmiths.

Table 4.18 Estimates of Locally Hired and In-migrant Projected Employment.[1]

	1995 Quarters				1996 Quarters				1997 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Local hires	9	123	123	9	10	84	84	10	12	86	86	12
In-migrants	1	47	47	1	1	13	13	1	1	13	13	1

	1998 Quarters				1999 Quarters				2000 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Local hires	14	88	88	14	15	89	89	15	18	92	92	18
In-migrants	1	13	13	1	2	14	14	2	2	14	14	2

	2001 Quarters				2002 Quarters				2003 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Local hires	20	94	94	20	23	97	97	23	24	98	98	24
In-migrants	2	14	14	2	2	14	14	2	3	15	15	3

	2004 Quarters				2005-2034 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Local hires	26	100	100	26	26	26	26	26
In-migrants	3	15	15	3	3	3	3	3

[1] Local hires are those employees who were residents of Carbon or Albany Counties during the previous year. In-migrant employees are those employees who were not residents of Carbon or Albany Counties during the previous year. Table includes construction and O&M employees.

Table 4.19 In-migrant Population Projections, 1995-2034.[1]

	1995 Quarters				1996 Quarters				1997 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
In-migrant population	2	99	99	2	2	27	27	2	2	27	27	2

	1998 Quarters				1999 Quarters				2000 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
In-migrant population	2	27	27	2	4	29	29	4	4	29	29	4

	2001 Quarters				2002 Quarters				2003 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
In-migrant population	4	29	29	4	4	29	29	4	6	32	32	6

	2004 Quarters				2005-2034 Years
	1st	2nd	3rd	4th	
In-migrant population	6	32	32	6	6 additional in-migrants each year during this period.

[1] Based on Table 4.18. In-migrants are those persons who were not residents of Carbon or Albany County during the previous year. Assumes a household size of 2.1 for each in-migrant employee.

Table 4.20 Total In-migrant Population Distribution, 1995-1999.[1]

Location	Available Housing Distribution	Population, 1995 Quarters				Population, 1996 Quarters			
		1st	2nd	3rd	4th	1st	2nd	3rd	4th
Carbon County									
Hanna	11%	0	11	11	0	0	3	3	0
Rawlins	45%	2	45	45	2	2	12	12	2
Saratoga	19%	0	19	19	0	0	5	5	0
Albany County	25%	0	24	24	0	0	7	7	0
Total		2	99	99	2	2	27	27	2

Location	Population, 1997 Quarters				Population, 1998 Quarters				Population, 1999 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Carbon County												
Hanna	0	3	3	0	0	3	3	0	0	3	3	0
Rawlins	2	12	12	2	2	12	12	2	2	13	13	2
Saratoga	0	5	5	0	0	5	5	0	0	6	6	0
Albany County	0	7	7	0	0	7	7	0	2	7	7	2
Total	2	27	27	2	2	27	27	2	4	29	29	4

Based on Bureau of the Census (1992a, 1992b) and Table 4.19. Assumes limited housing availability in Albany County.

4.4.2.3 Housing

Little, if any, additional housing would be required for Windplant employees. Approximately 90% of employees would already live in the area. Additional housing would be required for 47 households in 1995 (Table 4.21), 13 households in years 1996 through 1998, and 14 households in 1999. As discussed in Section 3.4.3, vacant housing is available in the region and would be adequate to meet employees' needs; therefore, impacts on housing would be negligible for the LOP.

At least 861 housing units or spaces for temporary housing are available in the Carbon-Albany County area (see Section 3.4.3). More rental units are being advertised in Laramie than Rawlins, but there is a high student demand for these units. Construction workers during summer months would compete with tourists for space in campgrounds and units in motels. If housing demand increases in Carbon County, more housing units may come on to the market.

Housing in the immediate vicinity of the KPPA is limited. Housing is unavailable in the towns of Arlington, Elk Mountain, and McFadden. Opportunities are available in these communities and surrounding rural areas to purchase property and construct new housing.

Little impact would occur to the supply of housing in Carbon and Albany Counties. The project has a low demand for additional housing. No mitigation measures are needed.

4.4.2.4 Schools

Schools in the area are not experiencing crowding; both Carbon County School Districts have space for additional students (Section 3.4.4). Albany County schools can enroll additional students, but junior high and high schools are near capacity. Most students of Windplant employees would already live in the region. As a result of the proposed project, space would be needed for an estimated 17 additional students in 1995 which is projected to decrease to 5 students in 1996 (Table 4.22). Current facilities would be able to handle the additional students. Little impact would occur to schools as a result of the project. No mitigation measures would be needed.

4.4.2.5 Local Government Taxation and Revenue

Sales tax and *ad valorem* tax (property tax) would be paid to local governments by the Windplant (Appendix E); therefore, impacts to local government revenue would be beneficial for the LOP. Sales tax on purchases of equipment and services would be paid during the years 1996 through 2004 and would vary from a high of $2,316,834 (in 2003) to a low of $1,445,705 (in 2004). Currently, sales tax is paid at a rate of 5% in Carbon County with 4% going to the State of Wyoming and 1% going to Carbon County.

Property tax would be paid throughout the LOP. Assessed value of the Windplant is 11.5% of the Windplant's fair market value, which would increase during Windplant construction (through 2005) and then depreciate (2006 to 2034). Property tax to be paid annually by the Windplant would range from $790,014 in 1996 to $5,668,369 in 2005, then would decline to $16,063 in 2034 (Appendix E). Schools would receive 80.8% of the property tax; therefore, the project would have a beneficial impact on government revenues.

Impact assistance funds may be paid to Carbon and Albany Counties by the State of Wyoming to mitigate adverse impacts to communities affected by Windplant construction and operation. The industrial siting council

> . . . shall, after consideration of all evidence and recommendations presented at the hearing held pursuant to W.S. 35-12-110, establish a ratio for distribution of impact assistance funds to the county and to the cities and towns therein for the county where the industrial facility is located and shall certify that ratio to the county treasurer who will thereafter distribute the impact assistance payments

Table 4.21 Projected Housing Demand for In-migrants[1], 1995-1999.

Location	Available Housing Distribution	Housing Units 1995 Quarters				Housing Units 1996 Quarters			
		1st	2nd	3rd	4th	1st	2nd	3rd	4th
Carbon County									
Hanna	11%	0	5	5	0	0	1	1	0
Rawlins	45%	1	22	22	1	1	7	7	1
Saratoga	19%	0	9	9	0	0	2	2	0
Albany County	25%	0	11	11	0	0	3	3	0
Total		1	47	47	1	1	13	13	1

Location	Housing Units 1997 Quarters				Housing Units 1998 Quarters				Housing Units 1999 Quarters			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Carbon County												
Hanna	0	1	1	0	0	1	1	0	0	1	1	0
Rawlins	1	7	7	1	1	7	7	1	1	7	7	1
Saratoga	0	2	2	0	0	2	2	0	0	3	3	0
Albany County	0	3	3	0	0	3	3	0	1	3	3	1
Total	1	13	13	1	1	13	13	1	2	14	14	2

[1] Based on Table 4.20.

Table 4.22 Projected Distribution of In-migrant School Enrollment[1], 1995-1999.

Location	Available Housing Distribution	Additional Students 1995 Quarters 1st	2nd	3rd	4th	Additional Students 1996 Quarters 1st	2nd	3rd	4th
Carbon County									
Hanna	11%	0	2	2	0	0	1	1	0
Rawlins	45%	0	8	8	0	0	2	2	0
Saratoga	19%	0	3	3	0	0	1	1	0
Albany County	25%	0	4	4	0	0	1	1	0
Total		0	17	17	0	0	5	5	0

Location	Additional Students 1997 Quarters 1st	2nd	3rd	4th	Additional Students 1998 Quarters 1st	2nd	3rd	4th	Additional Students 1999 Quarters 1st	2nd	3rd	4th
Carbon County												
Hanna	0	1	1	0	0	1	1	0	0	1	1	0
Rawlins	0	2	2	0	0	2	2	0	1	2	2	1
Saratoga	0	1	1	0	0	1	1	0	0	1	1	0
Albany County	0	1	1	0	0	1	1	0	0	1	1	0
Total	0	5	5	0	0	5	5	0	1	5	5	1

[1] Based on Table 4.20 and a school-aged population of 17.8% of total population based on Bureau of the Census (1992a). Base year of 1994.

to the county and cities and towns therein pursuant to that ratio.

> The ratio of impacts shall be established in consideration of, but not limited to, the following factors:
> - The residency pattern of the facility's direct and induced employment;
> - The capital facility needs, social service needs, heath care needs, transportation needs, recreational needs, and police and fire protection needs of the affected local governments; and
> - The revenue structure, expenditure level, mill levies, and financial capabilities of the affected local governments . . . .
>
> . . . Upon the certification of a ratio to the county treasurer, the impact assistance payments shall thereafter be distributed pursuant to that ratio.
>
> The Council may adjust, revise, or modify a certified ratio during the construction of a facility. A governing body which is primarily affected by the facility, or any person issued a permit pursuant to W.S. 35-12-106, may petition the Council for review and adjustment of the distribution ratio upon a showing of good cause. The request shall be submitted to the Office of the Industrial Siting Administration . . . .
>
> . . . Pursuant to W.S. 39-6-411(c) and W.S. 39-6-512(b), the Council, upon request from the County Commissioners of an adjoining county, may determine that the social and economic impacts from construction of an industrial facility upon the adjoining county are significant and establish the ratio of impacts between the counties and certify that ratio to the state treasurer who will thereafter distribute impact assistance payments to the counties pursuant to that ratio or any revised, adjusted, or modified ratio certified under these regulations . . . .

4.4.2.6 Social Indicator Data

Most Windplant employees would be hired locally, so social indicators would either show no change or a slight improvement as a result of the project. Additional employment opportunities would be provided to about 123 persons living in the region in 1995. If any of these persons are living below the poverty level or receiving social assistance, employment at the Windplant would allow them the opportunity to improve their living standards.

For other social indicators such as education levels and crime rates, the Windplant project would have no effect. No mitigation measures are needed.

4.4.2.7 Community Characteristics, Facilities, and Infrastructure

The power generated by the Windplant will be exported to other states served by PacifiCorp, Tri-State, PSCo, EWEB, and BPA. The Windplant will provide a very small percentage of the power sold by Tri-State, the supplier of Carbon Power and Light (which services the communities around the KPPA). While the Windplant would not contribute to electric power rate decreases, it would help reduce potential rate increases for the customers of these four utilities and BPA for the following reasons:

- Unlike fossil fuel plants which are subject to fuel cost inflation, wind is free. In a typical gas-fired plant, for example, fuel makes up about 50% of the cost of each kWh. With a Windplant, the only portion of the kWh cost subject to inflation is O&M. Therefore, no fuel inflation costs (for Windplant-generated electricity) would be passed on to the customers of these utilities.
- The Production Tax Credit increases with inflation over the next 10 years, and this lowers the cost of Windpower proportionally each year.

Communities that would be most affected by the Windplant would be Arlington, McFadden, Elk Mountain, and Hanna. Since the Arlington/McFadden/Elk Mountain/Hanna area would be the only location in Wyoming with a wind-generated electric power plant, the Windplant would be a key community characteristic of these four communities, but this is not expected to be significant. Characteristics of other communities in Carbon and Albany Counties would not be affected by the Windplant. The project would not impact community facilities and infrastructure in other communities. No large-scale population increase would occur that would require the construction of new community facilities and infrastructure.

Landowners within the KPPA would benefit directly from the project through land rental. Amounts to be paid are proprietary.

The Windplant would require electricity, water, and sewer services. Electricity would be provided by Carbon Power and Light Company. For 500-MW generation, the Windplant would require 2.5 MW of electricity when the ambient temperature is above 32 °F (0° C) and 3.5 MW when the temperature is below 32 °F (0 °C). For 70.5-MW generation, 350 kilowatts (kW) of electricity would be required when the ambient temperature is above 32 °F and 900 kW when the temperature is below 32 °F (0 °C).

Water for the Windplant would be obtained from existing wells. Solid waste and sewage would be collected and disposed of in compliance with all applicable regulations by a local contractor.

Impacts on transportation within and adjacent to the KPPA would be negligible for construction and the LOP. Traffic would increase on I-80 and Wyoming Highways 30/287, 13, and 72, but these highways are currently well under service capacity (Section 3.4.8) and would easily accommodate the additional traffic. Roads built or improved for Windplant construction and O&M would be designed for their expected level of service and types of vehicles (e.g., large tractor-trailers hauling towers, nacelles, rotors, transformers, etc.). All vehicles and loads would be in compliance with state and federal regulations.

4.4.2.8 Overall and Indirect Benefits

Beneficial impacts would include jobs produced, materials purchased, state and local taxes paid, and capital investment:

- The total value of materials to be purchased in Wyoming during the LOP is estimated to be $44,076,699 (net present value of $19,973,552 at 7%).
- State and local taxes paid during the LOP would total $121,199,776.
- Capital investment during the LOP would total $671,444,967 (net present value of $473,614,323).

4.4.3 Alternative A

Under Alternative A, each phase of Windplant development would probably be similar to the Proposed Action (i.e., 50- to 100-MW phases would be built) but because the Windplant would be reduced in size, the number of phases would be reduced; therefore, the number of construction years would be reduced by approximately 40%. Construction probably would occur from 1995 through the year 2000 instead of 2004, reducing the overall construction work force by 86 employees per year for four years. Similarly, because there would be fewer turbines, the O&M staff would be reduced from 29 to approximately 21 Windsmiths. The annual number of in-migrants during construction (1995 to 2000) would probably be the same as for the Proposed Action because labor forces needed for construction would be similar. Transmission line construction employment would be the same as for the Proposed Action.

Employment levels at the Windplant would represent less than 1% of total employment in Carbon and Albany Counties and would be a short-term beneficial impact, but benefits would be reduced by approximately 40% from the Proposed Action. Short-term adverse impacts during the last quarter of each construction year would be the same as for the Proposed Action, but would not occur during 2001 to 2004.

Construction payroll would start at $3,169,285 in 1995, decrease to $1,750,635 in 1996, and gradually increase during the construction period to $2,059,700 in 2000 (Appendix E). The O&M payroll would start at $253,094 in 1995 and increase to approximately $2,258,861 in 2034 (assuming a 40% reduction in O&M payroll). Average salaries would be the same as for the Proposed Action. Total payroll paid during the LOP would be approximately $57,661,456.

Few long-term employment impacts would result from Alternative A. Jobs created by the Windplant would represent a small proportion of total employment in the region, and thus, no mitigation measures would be needed.

Under Alternative A, population would change very little during Windplant development. Impacts under the Proposed Action would be negligible, and thus, the reduced Windplant would also have negligible impacts on population. Approximately 45% of in-migrants would be expected to move to the Rawlins area to avoid competition for housing with students in Laramie.

Little, if any, additional housing would be required under Alternative A. Competition between construction workers and tourists during summer months would be the same as for the Proposed Action but would cease in 2000. Additional housing would be required for 47 households in 1995 (Table 4.21) and another two households during the period from 1996 through 2000. Vacant housing is available in the region and would be adequate to meet employee needs.

Because housing impacts would be negligible under Alternative A, no mitigation measures would be needed. Impacts on schools also would be negligible.

Sales tax on purchase of equipment and services would range from $1,760,604 in 1996 to $2,059,657 in 2000. Property tax paid annually by the Windplant would range from approximately $9,638 in 2034 to $1,833,755 in 2000. Schools would receive 80.8% of the property tax; therefore the project would have a beneficial impact on government revenues. Impact assistance payments, discussed in Appendix E, would be lower than for the Proposed Action. No other mitigation measures would be needed.

Social indicators would either show no change or slight improvement under Alternative A.

The communities of Arlington, Elk Mountain, McFadden, and Hanna would be most affected by Alternative A; however, Windplant development would not impact facilities or infrastructure of these or other communities in the area. Rental to landowners would be at the same rate as for the Proposed Action.

Impacts under the Proposed Action are primarily beneficial, and thus, Alternative A would result in reduced benefits:

- The total value of materials to be purchased in Wyoming during the LOP would be approximately $26,446,019.
- State and local taxes paid would total approximately $72,719,866.
- Capital investment during the LOP would total $402,866,980.

4.4.4 No Action

Under the No Action Alternative, beneficial impacts from increased employment and increased state and local tax revenues would not be realized. No adverse affects due to Windplant development would occur.

4.4.5 Cumulative Impacts

Cumulative impacts of the Windplant project and three other projects in Carbon County are shown in Table 4.23. The environmental analysis for the proposed Medicine Bow windfarm has not been completed and thus is not included in this table. The other three projects are located in western

Table 4.23 Socioeconomic Cumulative Impacts.

Category	Creston/Blue Gap Natural Gas Project[1]	Mulligan Draw Gas Field Project[2]	Greater Wamsutter Area Natural Gas Project[3]	Proposed Action
Type of project	Natural gas	Gas field	Natural gas	Windplant, electricity generation
Years of duration	1994-2019	1992-2022	1992-2012	1995-2034
Employment	Up to 180 persons, local	40-100 persons, local	240-340 persons, local	9-29 O&M employees; 86-161 construction employees; 90% local employment
Payroll				
Average annual	$ 3,319,000	$667,000-$867,000	No data available	$ 2,403,000
Total	$82,987,000	$20,000,000-$26,000,000		$96,103,000
Population	Short-term population increases	Negligible population increases, short duration	Short-term 50% increase in Wamsutter's population	Negligible long-term population increase
Housing	Adequate housing available	Adequate housing available; workers already living in area; site work camps may be used	Possible temporary relocations	Demand for 47 additional housing units in 1995; 12 units in years 1996-1998, and 14 units in 1999
Schools	No data available	No data available	No data available	Space required for 5-17 additional students by year 1999
Local sales, severance, and *ad valorem* taxes	Annual average: $ 2,427,200 total during LOP: $72,816,000	Annual average: $ 1,900,000 to $ 2,200,000 total during LOP: $57,000,000 to $65,000,000	Annual average: $ 1,188,000 total during LOP: $23,760,000	Annual average: $ 302,999 total during LOP: $121,199,776
Social indicators	Minor crime increase; decreased unemployment	Minor crime increase; decreased unemployment	Disruption of ranching operations; decreased unemployment	Decreased unemployment
Communities directly affected	Baggs and Wamsutter	Baggs and Wamsutter	Wamsutter	Arlington, Elk Mountain, McFadden, and Hanna

[1] BLM (1994d).
[2] BLM (1992b).
[3] BLM (1992a).

Carbon County, away from the KPPA. All four projects would produce increased employment and tax revenues. Population impacts of the projects would be low-level except for short-term population increases from the Greater Wamsutter Area Natural Gas Project in the community of Wamsutter. Impacts on housing supply and schools from these projects are expected to be negligible. A minor crime increase is expected from the other three projects. This should effect communities in western Carbon County rather than communities in eastern Carbon County where the Windplant is proposed.

4.5 LAND USE

4.5.1 Significance Criteria

Impacts to land use would be considered significant if Windplant development resulted in violations of prior land use rights.

4.5.2 Proposed Action

Under the Proposed Action, no significant impact in land use is expected. Moderate impacts would occur due to an overall change in landscape character from a remote to an industrial character and a decline in the aesthetic quality of the land for recreational uses.

No permanent changes in land use would occur within the KPPA as a result of the Proposed Action; all surface equipment would be removed from the area at the end of the economic life of the project, and reclamation would restore disturbed sites to near pre-project conditions. The Proposed Action would be in conformance with county, state, and/or federal land use plans (Carbon County Planning and Development Commission 1983; Wyoming State Land Use Commission 1979; BLM 1987).

Approximately 319 ac (<1% of the KPPA) of new disturbance would occur during Phase I of the Proposed Action (Table 4.1). Initial reclamation following construction would reduce the disturbance area to 68 ac. The 500-MW Windplant would initially disturb approximately 1,787 ac (3%) of the KPPA. This disturbance would be reduced to 715 ac (1%) for the LOP. The project would temporarily change the land use of specific sites to energy development and displace or interfere with some historical land uses on a localized basis as described below.

4.5.2.1 Landscape Character

The shortgrass prairie/sagebrush steppe ecosystems within the KPPA support multiple land uses, primarily livestock and wildlife grazing and foraging. Mineral development and dispersed recreation also occur (Section 3.5). Based on the quantitative analyses provided below, none of the current land uses would be significantly impacted by the Proposed Action. Furthermore, the proposed Windplant would be an additional beneficial use of the land (as an electric power generator). However, in a qualitative sense, landscape character would be significantly altered.

Within the Simpson Ridge area, the KPPA landscape is relatively pristine, and the mark of man is not readily apparent. These remote lands are generally undeveloped, and they epitomize the harsh beauty that many people associate with Wyoming's uninhabited high plains. Current land uses neither diminish these aesthetic qualities of the landscape nor do they significantly detract from them. However, large numbers of wind turbines, roads, power lines, and substations distributed throughout the KPPA would change the overall appearance of the landscape. The relatively undeveloped and pristine landscape would take on an industrial character. While little quantifiable recreational use occurs within the KPPA, the conversion of 60,619 ac from a relatively undeveloped to a primarily industrial character is a qualitative loss of wildland. In addition, secondary impacts from increased traffic on new roads and increased human presence within the KPPA, as well as the accompanying wildlife disturbance (including poaching), noise, exhaust emissions, vandalism, and litter would occur.

On the Foote Creek Rim area, 5,000 ac would be used to support the multiple land uses, including the operation of a 200-MW Windplant (25 ac/MW). During early planning, KENETECH enlarged the Simpson Ridge Project area so KENETECH and the BLM would have greater opportunity to locate turbines and other facilities in environmentally preferable areas and thereby avoid or minimize impacting sensitive resources. Future PODs (post-Phase I) may identify critical areas where Windplant development would be prohibited (e.g., RCAs, cultural resource sites); therefore, it is unlikely that 500-MW Windplant development would occupy the entire Simpson Ridge area.

KENETECH's Windplant in Minnesota uses Model 33M-VS turbines, and the 25-MW Windplant occupies a 2,000-ac project area (80 ac/MW). In the Environmental Impact Report for the SMUD-Solano Wind Project (SMUD 1993), an estimated 4,000 ac would be used to generate 50 MW (80 ac/MW). Acres used per MW of capacity within the Simpson Ridge area would probably be about the same (i.e., 80 ac/MW) because the winds are not as strong as those in the Foote Creek Rim area. Assuming the worst case for the Simpson Ridge area (i.e., utilization of the entire 54,893-ac project area), the Windplant would occupy 183 ac/MW, or about twice the amount of land used per MW compared with the Minnesota and California sites. This would be a significant change in landscape character over a large area. If the Simpson Ridge portion of the Windplant only uses 80 ac per MW, then only 24,000 ac within the Simpson Ridge area would take on an industrial character.

The Windplant capacity factor (i.e., the average power output relative to the total potential output) also would affect ac/unit output. The Foote Creek Rim portion of the Windplant is expected to have a capacity factor of 72.8% (i.e., the Windplant would typically operate at 72.8% of its capacity) (Section 1.1.2); therefore, land use would be approximately 34 ac/MW. Assuming that the capacity factor would be similar within the Simpson Ridge portion of the Windplant, 110 ac/MW would probably be needed. Under the worst case scenario, 251 ac/MW would be used.

To reduce land area occupied by the Windplant within the Simpson Ridge area, turbines could be clustered into selected areas, where turbine densities would be higher than if they were more evenly dispersed. Effects of turbine density on such resources as raptors and big game herds are as yet unknown, but would be monitored and quantified as each phase was built. The BLM may recommend increasing turbine densities in the Simpson Ridge area to reduce the amount of land impacted by the aesthetic change and accompanying secondary impacts.

As future phases are planned, PODs would analyze potential impacts of higher turbine densities on changes in land use character, as well as impacts on other resources, to minimize the amount of land used for the project, wherever feasible. Construction of the first few phases on the Foote Creek Rim area, where turbine density would average approximately 8 ac/turbine, would provide the opportunity to evaluate impacts from high turbine densities. If during monitoring, significant impacts can be directly or indirectly attributed to high turbine densities, early phases of project development in the Simpson Ridge area may require a higher dispersal of wind turbines to minimize these impacts. Priority would be given to resources protected by state and federal laws (e.g., the MBTA, ESA), or by prior management decisions (e.g., the GDRA RMP, ROW grant, stipulations resulting from this EIS). Each phase would be monitored to evaluate effects of turbine density on specific resources and assist in planning future phases.

4.5.2.2 Agriculture/Rangeland

Livestock grazing would continue within the KPPA throughout the LOP; impacts due to the proposed project would be negligible. However, there would be a reduction in available forage during construction, and to a lesser extent, for the LOP. Construction of the first phase would result in a loss of approximately 40 AUMs initially and

8 AUMs over the LOP. The greatest reduction in AUMs would occur within the Arlington Allotment; 12 AUMs (5% of the AUMs in this allotment) would be lost initially, and the LOP reduction would be approximately 6 AUMs (2% of the AUMs in this allotment).

The Proposed Action would result in a reduction of 243 AUMs initially and 93 AUMs over the LOP, distributed throughout seven grazing allotments. The greatest loss of AUMs would occur within the Arlington Allotment; 24 AUMs (9% of AUMs in this allotment) would be lost initially, and 11 AUMs (4% of AUMs in this allotment) would be lost for the LOP. Although forage reductions and impacts would occur, lessees are being compensated by KENETECH.

Mitigation for loss of forage would entail the reclamation of disturbed sites to range conditions equal to or better than pre-project conditions. As soon as practicable, reclamation and revegetation would be completed on areas no longer needed for project construction or operation. In addition, turbines and ancillary facilities would be situated such that livestock would not be denied access to water sources nor subject to project-related hazards. Therefore, effects on grazing and general livestock use would be negligible for the LOP and beyond.

4.5.2.3 Developed Water Resources

All construction activities and facilities would be located at least 500 ft (152 m) from perennial impoundments and 100 ft (31 m) from ephemeral impoundments to avoid potential impacts to these resources (Section 4.2.2). Impacts to developed water resources would be negligible.

4.5.2.4 Extractive Mineral Operations/Oil and Gas Production

Impact to mineral resources would be negligible for the LOP and beyond (Section 4.1.3).

4.5.2.5 Recreation

No developed recreation sites or facilities exist within the KPPA. Numerous dispersed recreational activities are available throughout the year; however, the number of individuals and amount of recreation time spent in the KPPA are not known. Access to private lands and public lands that require travel across private land is controlled by local landowners. Most BLM-managed lands on the KPPA that are currently open would remain open for public use for the LOP. The Wick Unit is accessible to the public via WGFD, Bear Creek Cattle Company, state, and BLM lands. Windplant development on four sections reserved for permanent public access by the WGFD would represent a prior rights and land status conflict. KENETECH is in the process of exchanging public access easements with the WGFD for release of public access easements on unaffected sections and portions of sections. Areas where public access would be denied for safety reasons include turbine locations and certain ancillary facility sites (e.g., substations). Most (90%) of the employees will be residents of Carbon and Albany Counties, so there is likely to be only a negligible increase in recreation demands from new employees moving into the area.

Construction, noise, dust, traffic, the presence of equipment, and associated human activities would change the character of the area and recreational experiences, such as backcountry hiking and camping, wildlife observation, horseback riding, nature photography, big game hunting, and ORV use. With the application of mitigation measures identified in Section 5.1.3.10, impacts to recreational opportunities due to vegetation or wetland disturbance would initially be moderate and would be negligible for the LOP and beyond. Because visual impacts will be significant in some areas (see Section 4.6), the aesthetic sense of a rural, undeveloped recreational area would be greatly reduced. In addition, areas proximal to turbine locations and other facilities may be avoided by some hunters and may negatively affect hunter recreational experiences. With improved access to the KPPA area, poaching and disturbance of big game and other wildlife may increase. However, increased accessibility throughout the KPPA area would enhance opportunities for hunting and wildlife observation for some recreational users.

The Windplant may attract tourists to the area. The wind turbines near Medicine Bow were listed in the area's promotional literature, and tourists as well as people from the region have travelled the gravel road to view the structures. The novelty of the Windplant and change from the relatively undeveloped prairie and sagebrush landscape along I-80 will likely cause some travelers to view the area with interest. Interpretive panels may be erected at Arlington, the Wagonhound Rest Area, Elk Mountain, or other locations along area highways to increase tourist interest in the Windplant. A short-wave radio broadcast may be used in the vicinity of the Windplant to educate passing motorists about the project and provide information on viewing and photographing the Windplant.

All surface equipment and structures would be removed during final reclamation. All turbine locations, selected roads, and other disturbed sites would be reclaimed to reestablish grazing lands and wildlife habitat and to restore the area for recreational use. Some roads may be retained upon project completion allowing increased recreational use of the area subject to private landowner permission to use private lands and roads. The 230-kV transmission line would be disassembled and structure locations reclaimed if it would not be used for other purposes after the LOP.

4.5.2.6 Land Status and Prior Rights

KENETECH and PacifiCorp have the appropriate leases to develop throughout the KPPA area, and proposed operations would not infringe on existing KPPA area ROWs or easements; therefore, there would be a negligible impact on prior rights in the KPPA area. Existing power lines and pipelines would be avoided, where practical, during construction. Structures associated with the 230-kV transmission line would be located at least 30 ft (9 m) from existing pipelines, where feasible. Alternates 1, 2, and 3 would cross pipelines at 5, 2, and 5 locations, respectively. The 243 AUMs lost during construction and the reduction of 93 AUMs for the LOP are being compensated for by KENETECH, so there would be a negligible infringement on the rights of grazing permittees. The Wick Unit is accessible to the public via WGFD, Bear Creek Cattle Company, state, and BLM lands and would not be impacted by the Proposed Action.

The WGFD has two permanent public access easements for "recreational" and other purposes on about 2,250 ac of Foote Creek Rim. Windplant development could occupy about 90 ac of these lands, and would not restrict public access to these areas. For the first phase of the project, KENETECH has agreed to acquire an additional access easement on other lands, and will convey that easement to the WGFD in exchange for the release of about 30 ac of existing public access easement on a portion of Foote Creek Rim. Any additional easement exchanges at Foote Creek Rim for subsequent phases would be on lands identified by the WGFD of comparable acreage and value.

4.5.3 Alternative A

Under Alternative A, no significant impacts to land use are anticipated. Impacts to landscape character would be similar to the Proposed Action but could be reduced by approximately 40% from the Proposed Action. It is likely that landscape impacts on Foote Creek Rim would be the same as for the Proposed Action because the wind regime on the Foote Creek Rim area is superior to that on the Simpson Ridge area; therefore Windplant development on the Foote Creek Rim area would probably proceed to or near to the full 200 MW, unless restricted by the BLM due to environmental concerns. Under this scenario, by reducing the overall size of the Windplant to 300 MW, only about 100 MW (275 turbines) would be constructed in the Simpson Ridge area. Assuming that the Simpson Ridge portion would occupy approximately 80 ac/MW, approximately 8,000 ac would be converted from relatively undeveloped to a primarily industrial character. Alternatively, if construction is prohibited on the Foote Creek Rim area due to environmental concerns (e.g., loss of mountain plover habitat), the 300-MW Windplant would be constructed entirely within the Simpson Ridge area and impacts to the Simpson Ridge landscape would be the same as for the Proposed Action.

The amount of disturbance within the KPPA under Alternative A would be reduced by approximately 40% from that of the Proposed Action. The initial reduction in AUMs under this alternative would be 97 (1% of total AUMs within the KPPA area); LOP reductions would total 37 AUMs (0.5% of the KPPA). Impacts under this alternative would be similar to those for the Proposed Action, and since the same mitigation measures would be applied, impacts would be negligible for the LOP and beyond. Beneficial impacts from increased tourism in the area would be similar to the Proposed Action. Impacts to mineral development, recreation, and prior land rights would be reduced by approximately 40% from the Proposed Action and would be negligible for the LOP.

4.5.4 No Action

No impact would occur to agricultural or recreational land use activities under the No Action Alternative. Mineral development in the KPPA is unlikely, and thus, the No Action Alternative probably would not affect area mineral resources (i.e., these would not be developed immediately to compensate for the lost power). Under the No Action Alternative, landscape character would not change due to the proposed project. The beneficial impacts of enhanced tourism would not be realized.

4.5.5 Cumulative Impacts

Because there are no quantifiable significance criteria for impacts to landscape character, cumulative impacts of Windplant development on landscape character cannot be evaluated in this EIS. However, each successive development in southern Wyoming incrementally decreases the amount of land that is relatively undeveloped, remote, and wild. Huge tracts of land have been used or are being considered for oil and gas development (Map 4.1), coal mining, other mineral development, and reservoirs; and these, coupled with the vast numbers of roads and other ancillary developments, substantially reduce the landscape quality throughout southern Wyoming.

Grazing allotments within and adjacent to the KPPA would not be significantly affected by development operations. The combined existing disturbance (439 ac) plus the proposed 500-MW Windplant would result in a LOP disturbance of 1,787 ac, or approximately 3% of the KPPA. The cumulative effect on grazing in the area by lessees (i.e., loss of forage) is being compensated for by KENETECH. Impacts on grazing from the Proposed Action plus other developments would most likely be negligible.

Moderate land use impacts have occurred in the region due to coal mining in the Hanna Basin. The coal mines north of the KPPA have incrementally disturbed 18,180 ac, 12,439 of which have been reclaimed and 5,741 ac, which are presently disturbed. Assuming that grazing and wildlife uses can begin on reclaimed areas within a few years after reclamation, and that disturbance acreage remains fairly constant, the mines account for the loss of about 5,741 ac of grazing lands and wildlife habitat in any one year. However, during coal mine reclamation, mined-out areas would be restored to approximate pre-mining land uses, including livestock grazing; therefore, no significant cumulative impacts would occur.

Windplant development in combination with other past and reasonably foreseeable future developments would result in a minor increase in demand for and impacts on recreational resources. Operation of the wind turbines would have a minimal cumulative impact due to the small number of people involved in O&M (29 people for the LOP) (Appendix E) and the fact that 90% of the employees would be current residents of

Carbon and Albany Counties. Increased big game displacement may occur (Section 4.2.3.1), which could limit hunting success, and the character of the area could be changed such that dispersed outdoor recreational activities would be reduced; however, an increase in tourism specific to the Windplant is likely. These would be moderate impacts.

Overall, cumulative impacts to land uses within the KPPA would be similar to those associated with the Proposed Action, since the same mitigation measures would be applied. No development would occur on lands subject to the WGFD public access easements until exchanges of those easements are successfully negotiated; therefore, there would be no prior rights or land status violations.

4.6 VISUAL RESOURCES

4.6.1 Significance Criteria

Impacts to visual resources would be considered significant if the proposed development conflicts with the BLM VRM objectives specified in the GDRA RMP (BLM 1987:64). Conflicts would include strong visual contrasts in VRM Class III areas.

4.6.2 Proposed Action

The VRM system uses a Visual Contrast Rating analysis to evaluate visual impacts of a proposed project, and to develop mitigation measures to reduce visual impacts. The degree to which a proposed activity would affect visual quality depends on the contrast between the existing landscape and the proposed development. Contrast is measured by comparing the basic elements of form, line, color, and texture of the existing landscape with the elements introduced by the project. Results of a visual contrast rating of the proposed project within the KPPA (see below) indicate that VRM objectives would be violated in large areas of the KPPA, and thus, visual impacts would be significant.

Visual simulations of the proposed Windplant at 6 KOPs within and adjacent to the KPPA were used to illustrate the visual elements (i.e., form, line, color, and texture) that would be associated with the Windplant (Appendix F, Photographs F.1-F.6). The proposed development primarily would consist of structural features (e.g., turbines, transmission lines, substations) and landform features (e.g., roads and pads). The expected visual characteristics of the proposed development are presented in Table 4.24.

Visual contrast ratings were computed by the BLM at KOPs 1, 2, 3, 4, and 5 (Map 3.24). Neither simulations nor contrast ratings were performed at KOPs 6 and 7. Landscape elements were compared to the elements that would be introduced by the proposed Windplant. A degree of contrast in form, line, color, and texture on landforms/water, vegetation, and structures was assigned to each landscape element as follows:

- none -- the contrast is not visible or perceived;
- weak -- the contrast can be seen but does not attract attention;
- moderate -- the contrast begins to attract attention and begins to dominate the landscape; and
- strong -- the contrast demands attention, will not be overlooked, and is dominant in the landscape.

A strong visual contrast rating would be acceptable in a VRM Class IV area but would not meet the VRM objectives in a VRM Class III area.

The visual contrast ratings for the five KOPs are presented in Table 4.25. Contrasts range from predominantly moderate [KOP 3 (McFadden School)] to predominantly moderate-strong (at the four other KOPs).

Management objectives for VRM Class III areas would be met at KOP 3 and in all Class IV areas (see Map 3.24 for locations of Class IV areas). Management objectives would not be met at KOPs 1, 2, 4, and 5, where strong contrast ratings occur within VRM Class III areas; therefore, significant

Table 4.24 Visual Characteristics of the Proposed Windplant.

Element	Land/Water	Vegetation	Structures
Form	Ridges horizontal	Flat/small clumps of shrubs/few trees	Vertical/narrow
Line	Horizontal/diagonal	Horizontal	Vertical/narrow
Color	Blue/gray/brown/green	Seasonal - green/brown	Carlsbad canyon with white blades (assumed)
Texture	Smooth with drainages	Smooth/small bumps	Clumped/uniform

impacts to visual resources would occur from the Proposed Action for the LOP. Because the landscape and vegetation within the area are predominantly horizontal/flat (Table 4.24) and the WTGs would introduce a strong vertical element into the landscape, the WTGs would create strong contrasts in the form and line of landforms and vegetation (Appendix F, Photographs F.1-F.6).

Visual impacts are greatly reduced with distance from the Windplant (Appendix F, Photographs F.1-F.6). No strong contrasts occur at the McFadden School (KOP 3), which is approximately 4.0 mi (6.4 km) from the proposed Windplant. Based on visual contrast rating results, VRM objectives probably would not be met in Class III areas where turbines are viewed at a distance of 2.5-3.0 mi (4.0-4.8 km) or less. KOPs 1, 2, 4, and 5 were all less than 3.0 mi (4.8 km) from the Windplant as pictured in the photo simulations, and strong contrasts were observed (Table 4.25). No visual contrast rating was completed for KOP 6, in the Simpson Ridge area, but the effects of disturbance on perceived contrast can be readily seen in Photo F.6 (Appendix F). Visual impacts will be greatest for Arlington residents, patrons of the KOA campground, and motorists on highways within and adjacent to the KPPA.

Mitigations for impacts to visual resources caused by Windplant facilities would include locating facilities within seldom-seen areas, where feasible; and painting turbine towers a flat, non-reflective BLM standard color (e.g., Carlsbad Canyon) and the blades a non-reflective white to improve visibility to birds (Section 5.1.3.11). Significant visual impacts would occur at close distances, but this color scheme would cause the WTGs to recede more quickly as viewing distance increases. The turbines, although highly visible, would provide interest for some viewers, especially people traveling through the area. The towers provide a change in scenery from the undeveloped grasslands and sagebrush found for many miles along the highways around the KPPA. This change will likely be viewed as favorable by some and undesirable by others.

Other visual impacts will occur due to land disturbance (e.g., road and pad construction), substation construction, and the erection of overhead collection lines and the 230-kV transmission line. Alternate 3 would be least visible from major highways [only 4.0 mi (6.4 km)]. Alternates 1 and 2 would be visible from highways for 20.0 mi (32.2 km) and 9.0 mi (14.5 km), respectively. Road cuts, pads, overhead lines, and substations, while possibly less visible than the WTGs, typically cause a negative response among viewers. Mitigation measures

Table 4.25 Visual Contrast Rating for 5 KOPs within the KPPA.

Area/KOP/Element	Land/Water Body	Vegetation	Structures
Foote Creek Rim Area			
KOP 1 - 1.5 mi (2.4 km) east on I-80 from Arlington exit			
Form	Moderate	Moderate	Moderate
Line	Moderate	Strong	Moderate
Color	Weak	Strong	Moderate
Texture	Weak	Moderate	Weak
KOP 2 - Arlington KOA campground			
Form	Strong	Strong	Moderate
Line	Strong	Strong	Moderate
Color	Moderate	Moderate	Moderate
Texture	Moderate	Strong	Weak
KOP 3 - McFadden School			
Form	Moderate	Moderate	Moderate
Line	Moderate	Moderate	Moderate
Color	Moderate	Moderate	Moderate
Texture	Weak	Weak	Weak
KOP 5 - 2.0 mi (3.2 km) west of Arlington on I-80			
Form	Strong	Moderate	Moderate
Line	Strong	Strong	Moderate
Color	Moderate	Strong	Moderate
Texture	Weak	Moderate	Weak
Simpson Ridge Area			
KOP 4 - 3.0 mi (4.8 km) north of I-80 on State Highway 72			
Form	Strong	Strong	Moderate
Line	Moderate	Strong	Moderate
Color	Weak	Moderate	Moderate
Texture	Weak	Weak	Weak

would be employed to avoid strong visual contrast ratings for these facilities and would include:

- locating facilities in seldom-seen areas, where feasible;
- minimizing vegetation disturbance;
- minimizing cuts and fills or other topographic alterations;
- prompt reclamation, including reshaping the landscape to its approximate original contour and revegetation with native species;
- minimizing the number of highly visible long linear features (e.g., creating switchbacks in roads on ridges); and
- screening facilities (e.g., planting vegetation screens around substations or prominent road cuts).

4.6.3 Alternative A

Reductions in visual impacts under Alternative A would depend entirely on turbine and other facilities placement within the KPPA. If turbines are placed throughout the KPPA, as was assumed for the Proposed Action, visual impacts would be roughly similar to impacts from the Proposed Action. If, however, turbines are placed in seldom-seen areas, visual impacts could be reduced. Mitigation measures similar to the Proposed Action would be employed, but significant impacts would occur within VRM Class III areas wherever turbines are viewed within 2.5-3.0 mi (4.0-4.8 km).

4.6.4 No Action

Under the No Action Alternative, no significant impact to visual resources would occur.

4.6.5 Cumulative Impacts

Cumulative impacts were evaluated by estimating the total acreage of the KPPA that would be occupied by WTGs within 3.0 mi (4.8 km) (the approximate threshold distance for strong visual contrast ratings) from major roads. Assuming that WTGs would be distributed throughout the Simpson Ridge area, Windplant development would result in a conflict with VRM Class III objectives on approximately 24,192 ac (40%) within the KPPA which constitutes a significant cumulative visual impact (Map 4.3). Although the environmental analysis has not been completed for the proposed Medicine Bow windfarm, portions of the project would likely be in VRM Class III areas; therefore, development would constitute a significant visual impact. Moderate impacts caused by new and existing roads and other developments would also occur throughout the KPPA. The character of the large portions of the KPPA would change from rural and undeveloped to a predominantly industrial landscape. The principal mitigation for these cumulative impacts would be placing turbines and new roads in seldom-seen areas away from major roads, where feasible.

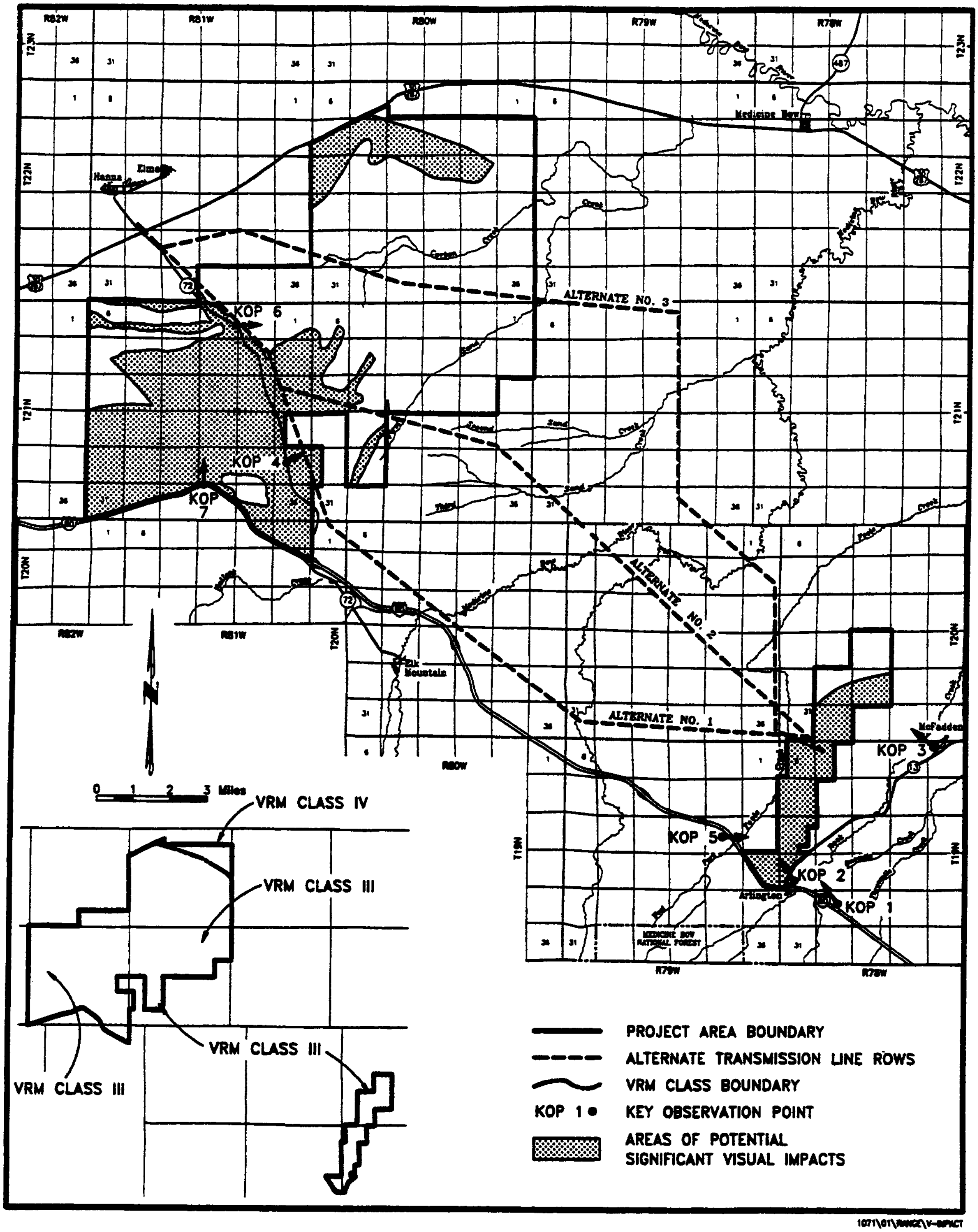
4.7 HAZARDOUS MATERIALS

4.7.1 Significance Criteria

Impacts resulting from the use of hazardous materials by the Proposed Action would be significant if these materials were to be produced, used, stored, transported, or disposed of in violation of either the HMMP or the Spill Prevention Control and Countermeasure Plans (SPCCPs) for the proposed project. The HMMP will be available for review at the BLM GDRA and Rawlins District Offices in March 1995, and will be included in the FEIS for this project.

4.7.2 Proposed Action

Impacts to soils, surface and groundwater resources, and wildlife could result from accidental hazardous material spills, transformer ruptures, or exposure of wildlife to these materials. Any spills would be cleaned up and the contaminated soils disposed of or rehabilitated as specified in the SPCCP (to be included in the FEIS; available from the BLM GDRA and district office in early 1995). The small amount of soil that potentially could be contaminated, coupled with appropriate and timely cleanup, would result in negligible potential soil impacts from accidental spills. Proper



Map 4.3 Location and Distribution of Areas Where Significant Visual Impacts Would Occur.

containment of oil and fuel in storage areas and location of facilities away from drainages would limit potential surface and groundwater contamination to negligible levels.

Since project operations would comply with all relevant federal and state laws regarding hazardous materials and with directives identified in the HMMP and the SPCCP for this project, no significant impact is anticipated.

4.7.3 Alternative A

The potential for hazardous material impacts under Alternative A would be reduced by approximately 40% from that of the Proposed Action. Since the same mitigation measures would be applied, no significant impact is anticipated.

4.7.4 No Action

Under the No Action Alternative, there would be no new impact from hazardous materials since no additional hazardous materials would be produced, used, stored, transported, or disposed of as a result of the project.

4.7.5 Cumulative Impacts

All existing oil and gas development projects within the KPPA use mitigation measures similar to or more stringent than those described for the Proposed Action to prevent soil contamination, surface and groundwater pollution, and wildlife exposure; therefore, impacts are expected to be negligible. The proposed Medicine Bow windfarm would probably use materials similar to those for the proposed Windplant (Section 3.7), and by employing similar mitigation measures, would not contribute substantially to cumulative impacts. None of the other developments within the KPPA involve the generation, storage, use, or transportation of hazardous materials; therefore there should be no additional cumulative impact.

4.8 UNAVOIDABLE ADVERSE EFFECTS

The mitigation measures incorporated in the project description throughout the preceding discussion of impacts and in Chapter 5.0 would avoid or minimize many of the potential adverse effects. However, not all adverse effects can be avoided, nor is mitigation 100% effective in remediating all impacts. There would be at least a minimal amount of unavoidable adverse impact on all resources present in the KPPA for at least a short time, due to the presence of equipment and humans in the area and the time necessary for mitigation (e.g., reclamation) to be effective. Significant unavoidable impacts associated with the project would include incidental taking of migratory and/or T&E birds without procurement of permits to allow such takings (Sections 4.2.3.3-4.2.3.4) and significant visual impacts associated with WTGs located in VRM Class III areas (Section 4.6). At this time it is unknown whether significant unavoidable impacts to cultural resources (i.e., sites with Native American significance) would occur (Section 4.3).

4.9 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irreversible and irretrievable impact is defined as a permanent reduction or loss of a resource that, once lost, cannot be regained. Most energy development projects (e.g., coal, oil, gas) result in an irreversible and irretrievable commitment of the power-generating resource (e.g., fossil fuels). Wind is a renewable resource that would not be depleted by the proposed project and would offset the need to consume fossil fuels.

The primary irreversible and irretrievable commitment of resources would be loss of individual birds via collisions with WTGs or other Windplant facilities. Animals killed during earth-moving activities or through collisions with vehicles are irreversibly and irretrievably lost. Also, loss of habitat by wildlife that are displaced by the Windplant O&M activities may be an irreversible and irretrievable loss.

Soil lost through wind and water erosion would be an irreversible and irretrievable loss from the KPPA.

The loss of productivity (i.e., forage, wildlife habitat) from lands devoted to project activities (i.e., WTG locations, roads) would be an irreversible and irretrievable commitment during the time that those lands are out of production and until they are successfully revegetated. Most of the land would be returned to production after reclamation and revegetation; however, the vegetation community may take more than 20 years after the LOP to recover.

Inadvertent or accidental destruction of paleontologic or cultural resources during construction would be an irreversible and irretrievable loss, but it is not likely to be a significant impact since archaeological and paleontologic data recovery and monitoring activities would be conducted as deemed appropriate by the BLM.

There would be an irreversible and irretrievable commitment of the energy used during construction, drilling, production, and reclamation associated with the proposed project. Foundations or other facilities greater than 6 inches (15 cm) below ground surface would be permanent and abandoned in place. They cannot be recovered due to practical or economic considerations, so they would be irreversibly and irretrievably committed. If the 230-kV transmission line would be used for other purposes after the LOP, this would be considered a permanent facility.

4.10 SHORT-TERM USE OF THE ENVIRONMENT VS. LONG-TERM PRODUCTIVITY

For the purposes of this discussion, short-term use of the environment is that use during the LOP, and long-term productivity refers to the period after the project is completed and the area reclaimed.

The short-term use of the environment would affect the resources as discussed in Sections 4.1 through 4.7 above. This use and the associated impacts would not significantly affect the long-term productivity of the KPPA or adjacent areas. After the project is completed and disturbed areas reclaimed, the same resources that were present prior to the project would be available. Because wind is a renewable resource, there would be no short- or long-term loss of this power-generating resource. It may take 20 years or more after the LOP for some of the reclaimed areas to revegetate; however, reclamation would provide conditions to support wildlife, livestock, and recreation. Use of the KPPA during the LOP would not preclude the subsequent long-term use of the area for any purpose for which it was originally suited prior to the project.

5.0 MITIGATION AND MONITORING

The mitigation and monitoring measures identified in this chapter are a recapitulation of measures presented in Section 2.1.11 and Chapter 4.0. Measures were developed in response to impacts identified in Chapter 4.0 and during the scoping process. Mitigation and monitoring measures describe how project activities would be implemented to assure compliance with federal, state, and local laws, resource management goals and objectives for the KPPA, applicable ROW stipulations, and additional environmental protection goals identified in Interdisciplinary Team (IDT) analyses. All mitigation and monitoring measures identified in this chapter would be applied to the Proposed Action or Alternative A. Mitigation and monitoring for Phase I would be the responsibility of KENETECH and PacifiCorp; other entities may own all or parts of future phases and would be responsible, along with KENETECH, for mitigation and monitoring.

The BLM GDRA Manager would be the AO for the proposed project. Mitigation and monitoring measures identified in this chapter may be modified by the AO based on new information or to further minimize impacts. IDT recommendations would be developed during field site analyses conducted during POD reviews and presented to the AO. Final mitigation and monitoring requirements would be determined by the AO.

Authorization to proceed with the implementation of this project on public lands would be contingent on receiving a completed POD from KENETECH and PacifiCorp and USFWS concurrence on the T&E species impact analysis. The POD for the first phase of development will be completed prior to issuing the FEIS for this project. Approval of the first phase POD will be contingent on the environmental analysis presented in the EIS and POD (see Section 2.1.2). Approval of subsequent phases would be contingent on completion and acceptance of future PODs.

The POD for each phase or each new transmission line would contain a construction schedule and detailed location maps which the AO, in consultation with other agency personnel (e.g., WGFD, WDEQ, USFWS), would approve on a case-by-case basis. This action would allow project activities to proceed in areas and/or during periods of restriction if deemed appropriate by the AO (e.g., during mild winters in crucial winter range or near abandoned raptor nests during the nesting season). Exceptions would be granted only in cases where adherence to ROW or POD stipulations is not possible or necessary and the Proposed Action is acceptable with proper mitigation. Public review of ROW or POD stipulation modification, waiver, or exception may be granted when deemed appropriate by the AO. ROW and POD stipulations may provide further mitigation and monitoring criteria that have not been identified in this EIS.

Reclamation plans would be provided as components of PODs according to guidelines established by the BLM. The reclamation plans would detail all practices necessary for reclamation on areas initially disturbed during construction that would not be required for the operation of the Windplant (e.g. staging areas along the transmission line route). Plans would include configurations of the reshaped topography and drainage systems, segregation and protection of topsoil, surface manipulations, waste disposal practices, soil treatments, and seed mixtures, and would incorporate the material applicable to reclamation presented in Chapters 2.0 and 4.0. A schedule for commencement and completion of reclamation operations would also be included. Similar reclamation plans would be prepared upon abandonment of all facilities.

Mitigation and monitoring measures identified would be adhered to on both federal lands and private lands affected by federal undertakings, subject to landowner preference or agreements.

5.1 MITIGATION MEASURES

5.1.1 Administrative Requirements

All phases of the Proposed Action would be conducted by KENETECH, PacifiCorp, other future Windplant owners, and their contractors in full compliance with all applicable federal, state, and local laws and regulations and within the guidelines specified in the approved ROW easement and PODs.

5.1.2 Preconstruction Planning and Design

The final location of each development site would be evaluated in the POD for each phase. Site-specific recommendations and mitigations would be developed by KENETECH, PacifiCorp, other Windplant owners, and the BLM or other landowners. Any proposed activity or surface disturbance would be accompanied by appropriate engineering design specifications, geotechnical analyses, mitigation plans, etc. This information would be of sufficient detail to demonstrate that all environmental resources would be adequately protected or that impacts to them would be adequately mitigated, consistent with the information presented in this EIS.

The following areas or situations may require more detailed or complex designs, plans, or analyses:

- slopes in excess of 25%;
- areas within 500 ft (152 m) of surface water and/or wetland areas;
- areas within 100 ft (31 m) of ephemeral or intermittent drainages;
- areas on unstable soils;
- construction when soils are frozen or saturated or when watershed damage is likely to occur;
- construction activities in crucial wildlife habitats (e.g., crucial winter range during critical winter periods); and
- construction at sites where cultural or paleontological resources are known to be present.

All sources of aggregate for construction materials would be identified by KENETECH, and the appropriate surface management agency (BLM, State of Wyoming) would approve the sources and times of extraction.

5.1.2.1 Transportation Plan

Preliminary road design plans are addressed in Section 2.1.4.1. Existing roads in the KPPA would be considered first for use as collector, local, and resource roads. These roads would be utilized whenever feasible in lieu of new construction because the BLM will not foster the proliferation of separate ROWs or perpetuate duplicate road systems on public lands. A preliminary road plan for the Foote Creek Rim area is shown on Map 2.1. Standards for road design would be consistent with BLM road standards (BLM 1985, 1991), and a BLM District Engineer would approve road design plans.

Individual road design plans for new and/or improved roads would be submitted for approval as components of the PODs. KENETECH, PacifiCorp, and other Windplant owners would schedule a review of plans with sufficient time to obtain BLM approval prior to commencement of work. Additionally, all project-related roads on public lands not required for project O&M or existing area activities would be recontoured, reseeded, and permanently blocked, where feasible. Roads on private lands would be similarly treated, subject to landowner preference or agreement.

KENETECH, PacifiCorp, and other Windplant owners would be responsible for necessary preventative and corrective road maintenance for the LOP. Maintenance responsibilities may include, but are not limited to, blading, gravel surfacing, cleaning ditches and drainage facilities, dust abatement, noxious weed control, or other requirements as directed by the AO. Windplant owners and operators are required to develop joint road use agreements designating road development, maintenance, and use requirements by area users. The road use agreements would identify responsibilities for necessary preventative and corrective road maintenance throughout the LOP.

5.1.2.2 Hazardous Material Containment

Notice of hazardous material spills or leakage (i.e., undesirable event) would be immediately given by KENETECH, PacifiCorp, or other Windplant owners to the AO and other such federal and state officials (e.g., WDEQ) as required by the Clean Water Act [40 C.F.R. Parts 110, 112, 125(k)], and other applicable state and federal laws. Any oral notice would be given as soon as possible, but within 24 hrs, and oral notices would be confirmed in writing within 72 hrs.

All project activities would be in compliance with the HMMP for this project and Windplant owners' SPCCPs (to be provided with each POD). The HMMP will be available for review at the BLM GDRA and Rawlins District Offices in early 1995, and the plan will be presented in an appendix to the FEIS for this project.

5.1.2.3 Stormwater Pollution Prevention Plans

KENETECH, PacifiCorp, and other Windplant owners would prepare the WDEQ-WQD SPPPs for activities requiring disturbances of greater than 5 ac. These plans will identify best-management practices, including erosion and pollution control procedures that would be implemented throughout the LOP to minimize surface water pollution. An SPPP would accompany the POD for each phase.

5.1.3 Resource-specific Requirements

5.1.3.1 Climate and Air Quality

Climate. Mitigations for snow accumulation impacts include, but are not limited to:

- locating WTGs away from snow accumulation areas, where feasible;
- incorporating downtower boxes into the tower itself or locating them on the downwind side of tower bases;
- surrounding transformers with shields or turbulence generators to disperse blowing snow;
- locating access roads on the upwind side of WTGs, if feasible;
- if it is not possible to locate roads on the upwind side of WTGs, locating roads a minimum of 105 ft (32 m) from transformers;
- minimizing fencing;
- using wing-type plows for snow removal, rather than blades.

Proper road design is the most important mitigation for minimizing impacts of the proposed project on snow distribution. For highway design, the recommended embankment height, H_e (m), above grade is given by (Tabler 1994a): $H_e = 0.4S + 0.6$, where S is average snowfall (m) over the snow accumulation season. For the project area, snowfall averages 7.9 ft (2.4 m), and therefore, the recommended embankment height would be 5.1 ft (1.56 m). Low-growing vegetation, strong winds, and less stringent standards would allow a somewhat lower embankment height to be used for service roads (which would also minimize overall disturbance due to roads).

Primary access roads would be located to avoid natural snowdrift areas. Cut sections would be designed to minimize drift encroachment on the roadway, using the general guidelines presented by Tabler (1994a), as appropriate. Where feasible, roads would be located and designed to obviate the need for snow fences which could reduce power output from the project and affect hydrology, soils, geologic hazards, vegetation, and wildlife.

Air Quality. Mitigations for air quality would include regular maintenance of internal combustion engines to keep them in good working condition, dust abatement on gravel roads and construction areas, and prohibition of open burning of refuse.

5.1.3.2 Topography

Site selection to avoid, where feasible, steep slopes, rugged topography, and perennial, intermittent, and ephemeral drainages and to minimize the area disturbed are the measures for reducing impacts to topography.

5.1.3.3 Minerals

The loss of access to potential mineral resources would be mitigated by avoiding areas of known accessible reserves, where feasible. If coal, oil, gas, or other mineral development within the KPPA becomes economical in the future, additional mitigations may be recommended by the BLM.

5.1.3.4 Geologic Hazards

Windplant facilities would be designed to UBC Zone 4 standards, which should be more than adequate to withstand the types of earthquakes that would typically occur in Carbon County. The probability of a severe earthquake occurring during the LOP is negligible.

Activities within potential landslide areas or on slopes greater than 25% would be avoided, where feasible. Unavoidable disturbance of these areas would be reviewed on a site-specific basis by the BLM during the POD/NTP process.

To mitigate potential impacts caused by flooding, construction in flood-prone areas would be limited to late summer, fall, or winter, when conditions are generally dry and streamflows are low. Additional mitigation to lessen any impact from flooding or high flows would include avoidance of areas with high erosion potential (i.e., steep slopes, floodplains, unstable soils); reestablishment of existing contours, where feasible; avoidance of areas within 500 ft (152 m) of open water and 100 ft (31 m) of ephemeral/intermittent drainage channels where feasible; and implementation of appropriate erosion and sediment control and revegetation procedures as identified in the PODs.

Windblown deposits would be avoided, where feasible, and areas necessarily disturbed would be seeded as soon as practical using an appropriate seed mixtures. If deemed appropriate by the BLM, disturbed areas would be mulched or otherwise protected to prevent wind erosion and facilitate successful reclamation. Specific measures would be detailed in the PODs.

5.1.3.5 Paleontologic Resources

The potential paleontologic value of construction sites would be assessed by BLM personnel during preconstruction surveys. Paleontologic surveys of disturbance areas would be conducted as determined by BLM to ensure that significant paleontologic resources are avoided or recovered prior to construction. If monitoring during construction is necessary, a BLM-qualified paleontologist would be required to be on-site during construction to mitigate direct and indirect impacts to significant paleontologic resources. Paleontologic surveys, data recovery, and monitoring would be conducted in accordance with BLM guidelines (BLM 1993b).

Any paleontologic resource discovered on public land by KENETECH, PacifiCorp, or other Windplant owners, or any person working on their behalf, would be immediately reported to the AO. Owners/operators would immediately suspend all operations at the site until authorization to proceed is issued by the AO. An evaluation of the discovery would be made by the AO to determine appropriate actions to prevent the loss of significant resources. KENETECH, PacifiCorp, or other Windplant owners would be responsible for the cost of evaluation, and any decision as to proper mitigation measures would be made by the AO after consulting with owners/operators.

5.1.3.6 Soils

The principal mitigation for adverse impacts to soils would be to minimize disturbance wherever feasible. Other mitigation measures would include, but not be limited to:

- leaving soils intact (removing vegetation only) during power line construction;
- avoiding construction at times when soils are frozen, whenever feasible;
- avoiding areas with high erosion potential (e.g., unstable soils, windblown deposits, slopes greater than 25%, floodplains), where feasible;
- selectively salvaging topsoil from disturbed areas, protecting topsoil stockpiles from wind and water erosion, and returning topsoil to regraded surfaces during reclamation;
- using appropriate erosion and sedimentation control techniques including, but not limited to, diversion terraces, riprap, and matting; and
- promptly revegetating disturbed areas using approved species.

In some areas, soils exposed during construction may require protection from erosion (e.g., soils with severe erosion potential). Temporary erosion control measures such as temporary vegetation cover; application of mulch, netting, or soil stabilizers; and/or construction of barriers may be used to minimize erosion in these areas prior to permanent reclamation. Specific problem areas would be identified during POD preparation, and site-specific mitigation measures (i.e., the design and placement of check dams, riprap, etc.) would be specified in the PODs.

Grading and landscaping would be used to reduce slopes created by cut-and-fill construction to maximum grades of 3 (horizontal):1 (vertical) on surfaces to be reclaimed, wherever feasible. Regraded slopes would conform, as much as is feasible, with the existing topography. Waterbars would be installed on disturbed slopes, where necessary, to divert runoff. Erosion control efforts would be monitored by the BLM, KENETECH, PacifiCorp, and other Windplant owners and augmented as necessary to control erosion.

Soils compacted during construction would be ripped and tilled as necessary to prepare a suitable seedbed. Cut-and-fill sections on all roads and along power lines would be revegetated with indigenous or BLM-approved species.

Any accidental soil contamination by spills of petroleum products or other hazardous materials would be cleaned up and the soil disposed of or rehabilitated as specified in the SPCCPs to be included in the PODs.

5.1.3.7 Water Resources

Disturbance in the vicinity of streams [500 ft (152 m) of perennial streams or 100 ft (31 m) of ephemeral/intermittent streams] would be avoided, where feasible, or minimized. Culverts would be installed at all appropriate locations as specified in *Manual 9112-Bridges and Major Culverts* (BLM 1984) and *Manual 9113-Roads* (BLM 1985, 1991). Streams would be crossed perpendicular to flow, where feasible, and all stream crossing structures would be designed to carry the 25-year discharge event or other capacities as directed by the BLM.

KENETECH, PacifiCorp, and other Windplant owners would ensure that state and federal water quality standards would not be exceeded. To accomplish this goal, appropriate erosion control measures and timely revegetation of disturbed areas would be implemented. Erosion-prone or high salinity areas would be avoided where feasible, and necessary construction in these areas would be done in the late summer, fall, and winter to avoid peak runoff periods. Proper containment of fuels, transformer oil, and lubricants and the location of staging areas away from drainages would prevent potential contaminants from entering surface waters.

Prudent use of erosion control measures described in Section 5.1.3.6 would be employed as necessary. Interceptor dikes would be used to control surface runoff generated along turbine strings, and dike location and construction methods would be described in the PODs for each phase. If necessary to reduce suspended sediment loads and remove potential contaminants, KENETECH, PacifiCorp, and other Windplant owners would treat diverted water in detention ponds prior to release into undisturbed vegetated land or into an established drainage. Prior to discharge, water would be treated or filtered, if necessary, to reduce contaminant levels and/or reduce suspended particles to meet applicable state or federal standards. If water is discharged into an established channel, the rate of discharge would not exceed the capacity of the channel to convey the increased flow. Waters that do not meet applicable state or federal standards would be evaporated, treated, or disposed of at an approved facility. SPPPs would be prepared as necessary.

Few, if any, groundwater impacts would occur due to the Proposed Action; therefore, no groundwater mitigations would be necessary.

5.1.3.8 Noise and Odor

All engines required for project activities would be properly muffled and maintained. All WTGs would be properly maintained to prevent excessive turbine noise. Construction and O&M activities would be limited during nighttime hours in the vicinity of residences, on crucial big game ranges during critical winter periods, proximal to active raptor nests during the nesting period, and adjacent to sage grouse breeding areas. Road use specifications designed to keep traffic to a minimum as identified in site-specific transportation plans would further reduce noise impacts.

No mitigation specifically designed to reduce project odors would be applied.

5.1.3.9 Electric and Magnetic Fields

No mitigation specifically designed to reduce EMFs would be applied. Fiberglass rotors would be used to prevent interruption of TV or radio signals.

5.1.3.10 Vegetation

Removal and disturbance of vegetation would be minimized through construction site management (e.g., using previously disturbed areas and existing easements, limiting equipment/materials storage yards and staging areas). Turbine corridors and associated overhead power lines would be located to avoid and/or minimize impacts in areas of high value (i.e., sensitive plant habitats, wetlands, riparian areas). Minimal vegetation removal would be employed during transmission line construction.

Revegetation using a BLM-approved seed mixture containing grasses, forbs, and shrubs (Table 5.1) would begin in the first appropriate season following disturbance. Vegetation removed would be replaced with plants of equal value using procedures that include, but are not limited to:

- fall reseeding (September 15 to freeze-up), where feasible;
- spring reseeding (prior to April 15) if fall seeding is not feasible;
- deep ripping or discing of compacted soils prior to reseeding;
- surface pitting/roughening prior to reseeding;
- utilization of BLM-approved introduced/adapted species (e.g., crested wheatgrass) in the seed mix on selected areas and if attempts at vegetation establishment with native species are unsuccessful;
- appropriate, BLM-approved weed control techniques;
- broadcast or drill seeding, depending on on-site conditions; and
- fencing of certain specific reclamation sites (e.g., riparian areas, steep slopes, areas where grazing may affect reclamation success) as determined necessary by the BLM.

Recontouring and seedbed preparation would occur immediately prior to reseeding unused portions of turbine string corridors, approximately 12.0 ft (3.7 m) on either side of the road ROWs, and the entire disturbed area along transmission line and overhead distribution/communications line ROWs. Reclamation would be monitored by the BLM annually or as specified in PODs to determine and

Table 5.1 List of Plant Species Suitable for Use in Revegetating Disturbed Areas.

Growth Form	Alkaline Soil Species	Non-Alkaline Soil Species
Grasses	Alkali sacaton	Bluebunch wheatgrass
	Sand dropseed	Thickspike wheatgrass
	Bottlebrush squirreltail	Slender wheatgrass
		Western wheatgrass
		Basin wildrye
		Sandberg bluegrass
		Needle-and-thread grass
		Crested wheatgrass (introduced)
		Russian wildrye (introduced)
Forbs	Scarlet globemallow	Scarlet globemallow
	Onion springparsley	Onion springparsley
	Desert parsley	Desert parsley
	Hoods phlox	Aster
	Prairie onion	Prairie onion
	Englemann daisy	Plains wallflower
	Evening primrose	Fleabane
		Englemann daisy
		Wild buckwheat
		Phlox
		Evening primrose
		Lewis flax
		Penstemon
Shrubs	Spiny hopsage	Common winterfat
	Gardner's saltbush	Antelope bitterbrush
	Shadscale saltbush	Greasewood
	Fourwing saltbush	Birdfoot sagebrush
		Big sagebrush

ensure successful soil stabilization and establishment of vegetation cover.

KENETECH, PacifiCorp, and other Windplant owners would be responsible for implementation of a noxious weed control program in cooperation with the BLM and Carbon County. Weed-free certification by county extension agents would be required for grain, straw, or hay used for mulching revegetated areas.

Windplant owners/operators would minimize disturbance of wetland and riparian areas by providing a 500-ft (152-m) vegetation buffer between disturbances and wetlands, where feasible. Established crossings or temporary bridges would be utilized, where feasible, and all staging areas would be placed away from wetlands. Avoidance of wetlands would be a primary objective.

Where wetland areas must be crossed, as determined during site-specific POD preparation, the primary objective would be soil stabilization through the reestablishment of vegetation cover by native species. Exact procedures and species used would be dependent on site-specific objectives. Compliance with Executive Orders 11988 (floodplain protection) and 11990 (wetland protection) would be assured through consultation with the COE, and during the associated Section 404 permitting process.

Further mitigations for disturbed wetland areas include, but are not limited to:

- limiting development of crossing to periods of only dry conditions (i.e. late summer, fall, winter);
- restoring areas to preproject conditions to the extent feasible, and compacting soils to reestablish impermeability, if impermeable soils contributed to wetland formation;
- selectively salvaging, stockpiling, and replacing wetland topsoils to facilitate the reestablishment of functional wetlands; and
- recontouring and seeding banks with BLM-approved, adapted species in the first appropriate season after construction to facilitate soil stabilization.

5.1.3.11 Wildlife and Fisheries

Big Game. Windplant facilities (e.g., turbine towers, roads, transmission lines) would be placed to minimize or avoid disturbance in areas with high value wildlife habitat (e.g., crucial ranges, wetlands, riparian areas).

WTGs and associated downtower structures would not be placed in big game crucial range if it is economically feasible to construct them in noncrucial habitat. If this is not feasible, construction activities on big game crucial winter and crucial winter/yearlong ranges would be curtailed during critical winter periods (i.e., November 15 through April 30) unless exceptions are arranged with the BLM. KENETECH would schedule construction programs so that proposed facilities located within crucial ranges would be constructed and/or installed during spring, summer, and fall.

During the winter, escape openings would be provided along access roads in big game crucial ranges as designated by the BLM and WGFD to facilitate exit of big game animals from snowplowed roads. Some roads within the KPPA may be closed (i.e., gated and locked) to deny unauthorized access during critical winter periods. To minimize displacement and stress of animals, KENETECH would instruct workers and contractors to avoid unnecessarily stopping and/or exiting their vehicles, especially in big game winter habitat while there is snow on the ground. Additional on-site mitigation measures within crucial winter ranges (e.g., various habitat improvement practices) may be required by the BLM for phases subsequent to Phase I to compensate for unavoidable loss of crucial winter range.

Windplant substations would be fenced to prevent big game and livestock access. All construction and maintenance vehicles would be muffled to minimize engine noise levels and subsequent disturbance to wildlife.

To minimize wildlife mortality due to vehicle collisions, KENETECH would advise project personnel regarding appropriate speed limits on the KPPA, and roads would be reclaimed as soon after they are no longer required, as feasible. In addition, project-related travel would be restricted to that necessary for efficient project operation on roads located in big game crucial ranges during critical winter months and mountain plover nesting areas during the nesting season to minimize stress on wildlife. Potential increases in poaching would be minimized through employee and contractor education regarding wildlife laws.

Raptors. As information from current research and future monitoring becomes available, WTGs and associated facilities would be designed and located to minimize raptor mortality. Current KENETECH-sponsored research into avian-turbine interactions is focused on three areas: 1) visual and auditory stimuli most effective in improving raptor recognition of WTGs as obstacles; 2) raptor (avian) evasive behavior in an operating Windplant; and 3) dynamics of a golden eagle population in California (i.e., Altamont Pass) (KENETECH 1994). Other research evaluating the influence of WTG characteristics (e.g., upwind vs. downwind orientation) and topographic features on WTG-induced raptor mortality is also being conducted. For example, research is being conducted to determine if turbines with a larger rotor diameter are associated with higher raptor collision rates than turbines with a smaller rotor diameter. It is anticipated that many years of additional research will be required before the relationship of WTG characteristics and raptor mortality can be conclusively determined. Research at Windplants in California suggests that WTGs mounted on tubular towers are associated with lower raptor mortality rates than those mounted on lattice towers; therefore, KENETECH has proposed to use modified tubular towers in the Proposed Action; they would also be used under Alternative A.

Avian task force research results would be used to design and improve mitigation measures to reduce avian mortality at KENETECH's windpower projects nationwide, as well as within the KPPA. Furthermore, the results of this research, combined with site-specific field data collected within the KPPA have been used to design an intensive monitoring program (Appendix B) to be implemented with the construction of each phase. The monitoring program would help determine project impacts on raptors and other birds, and would also assist in the development of effective and appropriate mitigation measures for future phases as the project proceeds.

Activities near active raptor nests (nests known to have been used within the last three years) would be prohibited within a 0.75-mi (1.21-km) radius or other distance as deemed appropriate by the BLM to avoid disturbing birds during the nesting season (February 1 through July 31). If areas adjacent to active raptor nests must be disturbed during construction, project activities would occur outside the nesting season. Mitigation for raptor nests for phases subsequent to Phase I would be designed on a site-specific basis in consultation with the BLM, USFWS, and WGFD. KENETECH would notify the BLM immediately if raptors are found nesting on project facilities.

Other mitigation measures for raptors within the KPPA include, but are not limited to:

- implementation of suggested practices for raptor protection on power lines (Olendorff et al. 1981);
- marking ground wires on power lines, if necessary (Beaulaurier 1981; Beaulaurier et al. 1984);
- placing WTGs, roads, and power lines away from raptor high-use areas (e.g., areas with high concentrations of nests, foraging areas) as stipulated in the PODs; and
- following suggested disturbance buffers for wintering raptors (Holmes et al. 1993).

Opportunities to introduce experimental design into post-Phase I phases of development would allow testing the effectiveness of proposed mitigations. For example, various rotor color schemes may be used within the Windplant to evaluate the effects of turbine blade color and pattern on raptor mortality rates. Other potential environmental impacts resulting from such experimental designs (e.g., increased impacts to visual resources) would be evaluated, to the extent necessary, prior to implementing mitigations for raptors.

Upland Game Birds. No activity or surface disturbance would be allowed within 0.25 mi (0.40 km) of a sage grouse lek center or a known nest site at any time. To protect probable sage grouse nesting habitat, no construction activities would be allowed within 2.0 mi (3.2 km) of lek between March 1 and June 30 unless exceptions are granted by the BLM. Project activities other than those required for O&M along existing roads within 0.25 mi (0.4 km) of known nests would be curtailed during the period from 1 hr before daylight to 9:00 am from March 1 through April 30. Collection and transmission line poles located within 0.25 mi (0.40 km) of sage grouse leks would be equipped with raptor antiperching devices to minimize the opportunities for raptors to prey on sage grouse.

Waterfowl, Shorebirds, Waders, and Passerines. Waterfowl, shorebird, wader, and passerine mortality would be minimized using the same mitigation methods discussed above for raptors. When feasible, WTGs and other facilities would be placed in locations and configurations that minimize avian mortality. Other mitigation measures [e.g., marking of ground wires on transmission lines (Beaulaurier 1981; Beaulaurier et al. 1984)] would be employed where feasible and appropriate. Monitoring of avian mortality on the KPPA would be implemented beginning with the first phase of development to determine project impacts on avifauna and to develop further mitigation measures, if needed.

Amphibians and Reptiles. No mitigation specifically designed to reduce project odors would be applied.

Fisheries. Potential impacts to fisheries would be minimized by using proper erosion control techniques (see Sections 5.1.3.6-5.1.3.7). Windplant construction within 500 ft (152 m) of open water and 100 ft (31 m) of intermittent and ephemeral channels would be avoided where feasible, and stream crossings would be constructed during the period of lowest flow (i.e., late summer and fall). If streambed crossings are necessary, they would occur perpendicular to flow, where feasible.

5.1.3.12 Threatened and Endangered/State Sensitive Species

Mammals. To minimize surface disturbance, prairie dog colonies crossed by transmission lines would not be bladed and staging areas would be located outside of prairie dog colonies. Raptor antiperching devices would be installed on transmission line poles within prairie dog colonies in the KPPA to eliminate perching opportunities for raptors that might prey on black-footed ferrets. In the unlikely event that black-footed ferrets are discovered in the project area, the USFWS, WGFD, and BLM would be consulted to determine the specific procedures necessary to protect the animals under the guidelines established for the reintroduced experimental population. Black-footed ferret clearance surveys may be conducted if ferrets were discovered and sufficient potential ferret habitat would be disturbed in subsequent phases of the project.

Birds. In the event that bald eagle roosting areas are found, a no surface occupancy restriction would be applied to a 1.0-mi (1.6-km) buffer zone around winter roosts, and the area would be closed to surface-disturbing activities (e.g., construction, drilling) from November 1 through April 1. If active bald eagle or peregrine falcon nests are found, no activity or surface disturbance would be allowed for up to a 1.0-mi (1.6-km) buffer zone around nests or active nests on artificial structures between February 1 and July 31.

If WTG and/or associated facility construction is planned between April 1 and July 31, a survey for mountain plover nests (and/or defending pairs of adult mountain plovers) would be conducted within 656 ft (200 m) of the area to be disturbed. If an active mountain plover nest is located within the search area, no construction activity would be allowed until after July 31. Standard raptor mitigations (see Section 5.1.3.11) would be applied to construction areas near ferruginous hawk nests, as well as for ferruginous hawk nests built on project structures or active nests on artificial structures. Habitats in which state sensitive species are likely to occur would be avoided where feasible.

A BA for the proposed project assessing project impacts to T&E and candidate plant and animal species is currently being prepared. Copies of the BA will be available for review in early 1995 at the BLM GDRA and Rawlins District Offices.

Mitigation for T&E plant species would include, but not be limited to:

- surveying areas to be disturbed prior to disturbance,
- avoidance of known T&E populations, and if avoidance is not feasible,
- other mitigation approved by the USFWS and the AO.

5.1.3.13 Cultural and Historic Resources

Impacts to cultural resources would be mitigated following procedures specified in 36 C.F.R. 800. Class I and Class III inventories would be conducted on all federal and state lands and on private lands affected by federal undertakings. Cultural sites identified during those inventories would be avoided, where feasible. Areas adjacent to perennial water and aeolian deposits also would be avoided, where feasible. Mitigation measures would be determined by BLM in consultation with the SHPO; the ACHP; appropriate Native American tribes; KENETECH, PacifiCorp, and other Windplant owners. If a large number of sites cannot be avoided, a programmatic agreement among the aforementioned parties may be developed.

An ethnohistoric study of Foote Creek Rim is currently being conducted to determine the possible significance of the rim to the cultural traditions of various tribes in Wyoming. If study results show that mitigations are necessary, appropriate mitigations would be developed by the BLM in consultation with the parties mentioned above, and included in the FEIS for the project.

Historic trails would be evaluated by a qualified historian, and contributing sections of historic trails would be avoided within 0.25 mi (0.40 km) unless such disturbance would not be visible from the trail or would occur in an existing visual intrusion area. The historic sites found near Carbon during the Class III survey of Alternate 3 would be spanned such that no structures are placed within the site. Mitigation of the site would include further data recovery of historic features. Because the site is eligible only under Criterion (D), no mitigation for visual effects would be needed.

Resources identified during Class III inventories of portions of the Foote Creek Rim area and Alternate 3 are presently being evaluated for NRHP eligibility in consultation with the BLM and SHPO. Features found during future Class III surveys would also be evaluated for eligibility. If any NRHP (eligible or listed) site cannot be avoided, a data recovery plan would be implemented as directed by the BLM.

In addition to the Class I and III inventories, construction activities in areas where the BLM believes there is a high potential for buried cultural deposits would be monitored by a BLM-permitted archaeologist. If historic or prehistoric materials are discovered during construction, further surface-disturbing activities at the site would cease, and appropriate BLM personnel would be notified by KENETECH, PacifiCorp, other Windplant owners, or their subcontractors to assure proper handling of the discovery by qualified archaeologists. An evaluation would be made by the AO to determine appropriate actions to prevent the loss of significant cultural resources.

Field personnel would be instructed not to disturb cultural resource sites or collect artifacts. KENETECH, PacifiCorp, and other Windplant owners would be responsible for the cost of the evaluation, and any decision as to proper mitigation measures (e.g., data recovery) would be made by the AO in consultation with the operator/owners. In the absence of a programmatic agreement, any discovered historic properties would be subject to mitigation through data recovery.

5.1.3.14 Socioeconomics

The primary measure for mitigating adverse impacts to communities affected by the proposed project would be the distribution of Impact Assistance Funds to Carbon and Albany Counties as required by WDEQ, Industrial Siting Council. Funds would be distributed to counties to offset impacts to infrastructure, housing, schools, etc. attributable to Windplant construction and operation (Section 4.4). Another primary mitigation would include commitments from KENETECH, PacifiCorp, or other Windplant owners to use local labor, where feasible. Windplant owners/operator would schedule concentrations of project traffic (e.g., truck convoys or heavy traffic flows) to avoid periods of expected increased traffic in the KPPA (i.e., the opening days of hunting seasons). Travel and parking would be restricted to access roads and on-site parking areas.

5.1.3.15 Land Use

Reclamation of nonessential areas disturbed during construction would be accomplished in the first appropriate season after construction. Nonessential areas include a 70.0-ft (21.3-m) wide corridor along turbine strings, 12.0 ft (3.7 m) on each side of all new roads, and all of the transmission and distribution line ROWs. KENETECH, PacifiCorp, or other Windplant owners would repair or replace fences and cattle guards and gates to maintain current BLM standards. Cattle guards would be used instead of gates for livestock control on most road ROWs. Livestock would be protected from underground cable trenches, and livestock access to existing water sources would be maintained.

Underground support structures (e.g., foundations) located greater than 6.0 ft (1.8 m) beneath the ground surface would be left in place, but all other facilities would be removed (after the LOP) to at least 6 inches (15 cm) below ground surface. Certain facilities (e.g., the 230-kV transmission line, authorized roads) may be left in place to be used for other beneficial purposes after the LOP.

Mitigations to prior rights include:

- locating facilities away from known underground cables and pipelines, where feasible;
- regrading and repairing roads as necessary in areas damaged by project-related activities;
- advance identification and flagging of all existing ROWs that would be crossed by proposed turbine strings, power lines, and roads;
- backhoe and hand excavation at pipeline crossings until the exact locations of underground lines have been determined; and
- restoration of native vegetation as soon as practical.

5.1.3.16 Visual Resources

Site-specific mitigations for impacts to visual resources would be identified during POD development. Aboveground facilities not requiring safety coloration would be painted with appropriate nonreflective environmental colors (e.g., Carlsbad Canyon or Desert Brown). Turbine blades would be nonreflective white or some other color scheme determined to improve rotor visibility to birds. Turbines and other facilities (e.g., roads, substations, power lines) would be located in seldom-seen areas, where feasible; facilities placement in foreground-middleground areas would be minimized, where feasible.

Cut-and-fill disturbance would be minimized. Long linear disturbances (e.g., roads) would be avoided or situated to minimize visual impacts where feasible. Revegetation would be initiated as soon as possible after disturbance. Topographic screening, vegetation manipulation, project scheduling, and traffic control procedures would be employed as deemed appropriate by the BLM to further reduce visual impacts.

Visual impacts from the 230-kV transmission line would be mitigated by locating the line in seldom-seen areas, where feasible, and using non-specular (low reflectivity) conductors and wooden poles.

5.2 MONITORING

KENETECH, PacifiCorp, and other Windplant owners each would identify an individual to serve as Environmental Compliance Coordinator (ECC). The ECC would be responsible for assuring that mitigation measures are implemented and monitoring activities are conducted as necessary to assure impacts are minimized.

5.2.1 Transportation and Facilities Construction

KENETECH, PacifiCorp, and other Windplant owners would provide qualified representatives on-site during construction to validate construction commensurate with the approved design.

5.2.2 Snow

Impacts of Windplant facilities on snow redistribution would be monitored by KENETECH O&M personnel; the Windplant also would be inspected periodically by authorized BLM or other agency personnel to identify potential problem areas. Methods would be specified in the POD for each phase and would include periodic examination of snow accumulation due to Windplant facilities and a report to the BLM on snow accumulation patterns. Possible problem areas would be inspected by the AO and/or other authorized BLM personnel to identify impacts and determine appropriate mitigation measures for future phases.

5.2.3 Paleontologic Resources

In addition to the predisturbance survey conducted as deemed appropriate by the BLM, specific, unavoidable high-value sites would be monitored as necessary by a qualified paleontologist during construction. If significant paleontologic materials are found during construction, all activities at the site would cease, and the AO would be notified immediately to assure proper handling of the discovery by a qualified paleontologist.

5.2.4 Soils

KENETECH, PacifiCorp, and other area operators would conduct regularly scheduled monitoring of erosion control structures within the KPPA to ensure maintenance of the operating integrity of these structures. Monitoring procedures and schedules would be specified in the PODs. Appropriate remedial action would be taken by owners/operators to correct nonfunctioning structures.

5.2.5 Water Resources

Windplant owners and KENETECH would conduct a regularly scheduled visual monitoring reconnaissance of surface waters to detect changes in water quality resulting from sedimentation. If necessary, periodic water samples would be analyzed to ensure that runoff from project areas is in compliance with federal and state water quality standards. Appropriate remedial actions would be taken to correct any noncompliance conditions.

5.2.6 Noise

Noise created by the Windplant would be monitored at sensitive receptor locations within the KPPA at least once per year. A BLM-approved monitoring system would be installed at selected receptors (e.g., known active sage grouse leks) for a period of at least a week to obtain a range of noise conditions. Windplant-generated noise would be evaluated by a qualified professional, impacts identified, and appropriate mitigations implemented, if necessary.

5.2.7 Vegetation

The ECCs would monitor activities adjacent to wetlands to ensure that no discharge or fill would disturb these areas. KENETECH, PacifiCorp, and other Windplant owners in cooperation with the BLM would be responsible for monitoring revegetation success using criteria specified in PODs. The reclamation monitoring program would include written documentation to be furnished to the BLM regarding the effectiveness and success of reclamation.

5.2.8 Wildlife and Fisheries

Big game populations would be monitored beginning with construction of Phase I in an effort to define the overall impact of the Windplant to big game species within the KPPA (Appendix B). ECCs would also monitor project activity in big game crucial ranges during critical periods to ensure that no unauthorized use occurs and that authorized activities in these areas are conducted in the most efficient manner possible to limit potential adverse impacts.

Raptor, passerine, waterfowl, and shorebird monitoring would continue during and after Windplant construction as outlined in Appendix B. All raptor nests within the raptor nest survey area (and any additional areas designated by the BLM, WGFD, and USFWS) would be monitored every year in spring to determine activity. If the nest is active, additional monitoring would be used to determine productivity.

Any big game, raptor, or game bird mortalities on the KPPA noted by KENETECH personnel or contractors would be reported to the BLM, USFWS, and/or WGFD as soon as practical.

5.2.9 Cultural and Historic Resources

In addition to Class I and III inventories, construction activities in areas where the BLM believes there is a high potential for buried cultural deposits would be monitored by a BLM-permitted archaeologist. If historic or prehistoric materials are discovered during construction, all activities at the site would cease, and appropriate BLM personnel would be notified to assure proper handling of the discovery by a qualified archaeologist.

5.2.10 Land Use

Road signs on the KPPA would be maintained and monitored as deemed appropriate by the BLM. KENETECH, PacifiCorp, and other Windplant owners would conduct all maintenance and monitoring operations to ensure that signs are in proper repair and placed in the appropriate locations. Construction monitoring by the BLM may be conducted where proposed facilities cross existing underground pipelines or cables.

5.2.11 Hazardous and Solid Waste

Hazardous materials used, transported, stored, and disposed of as a component of this project would be in accordance with all federal and state rules and regulations and the HMMP for this project. This plan will be available for review at the BLM GDRA and Rawlins District Offices in early 1995, and will be included as an appendix to the FEIS for this project.

Any hazardous material spills would be handled as specified in SPCCPs (to be included in the PODs for each phase). The ECCs would be responsible for reporting spills of hazardous materials and implementing applicable procedures, monitoring, and reporting requirements.

Refuse would be hauled to state-approved sanitary landfills or other disposal sites. KENETECH, PacifiCorp, and other Windplant owners would store refuse collected on-site in containers prior to transport.

6.0 CONSULTATION AND PREPARERS

Personnel contacted or consulted during preparation of this EIS are listed in Table 6.1. The list of preparers and participants is given in Table 6.2.

Table 6.1 Personnel Contacted or Consulted.

Agency or Organization	Individual	Position
Albany County School District No. 1	Mike Bowman	Assistant Superintendent
Bonneville Power Administration	George Darr	Civil Engineer, P.E.
	Kathy Fisher	Environmental Specialist
	Chris Kondrat	Contract Manager
	Linda McKinney	Public Utility Specialist
	Kathy Pierce	Lead Environmental Specialist
	Colleen Spiering	Environmental EMF Specialist
	Richard Stone	Environmental Specialist
	Ben Underwood	Attorney
Bureau of Land Management		
Great Divide Resource Area	Frank Blomquist	Rangeland Management Specialist
	Tim Bottomley	Planning & Environmental Coordinator
	Connie Breckenridge	Wildlife Biologist
	Gary DeMarcay	Archaeologist
	Susan Foley	Soil Scientist
	Cheryl Hicks	Rangeland Management Specialist
	Mark Newman	Geologist
	Tom Rinkes	Wildlife Biologist
Rawlins District Office	Mary Apple	Public Affairs
	Dennis Carpenter	Assistant District Manager
	Missy Cook	Environmental Coordinator
	Walt George	Environmental Coordinator
	Ray Hanson	Recreation Planner
	Dick Larsen	Hazardous Materials Specialist
	Bob Tigner	Planning & Environmental Specialist
Cheyenne State Office	Tom Lahti	Landscape Architect
	Tim Novak	Cultural Resource Specialist
	Al Pierson	State Supervisor
	Roger Wickstrom	Natural Resource Specialist

Table 6.1 (Continued)

Agency or Organization	Individual	Position
California Fish and Game Department	Frank Wernette	Wildlife Biologist
Carbon County, Wyoming		
Carbon County Coalition	Steve F. Adams	Director
Carbon County Economic Development	Gene McMillan	Director
Carbon County Planning Office	Nina Adams	Planning Director
Carbon County Road and Bridge Department	Don Newman	Department Head
Carbon County School District No. 1	Jon H. Fisher Gina Gelsleichter	Assistant Superintendent Secretary
Carbon County School District No. 2	Janice Fiedor Nancy Kreg	Secretary Secretary to Superintendent
CNF Constructors, Inc.	Shawn Briggs	Engineer
Individuals	William Glenn Goldie Pitcher Dale Yates Gus Winterfeld	Soil Scientist Area Resident Retired Realtor Paleontologist
Job Service	Margaret Blodgett	Manager
Judd Howell and Associates	Judd Howell	Biologist
KENETECH Windpower, Inc.	Robert Baker Richard Curry Bill Holly Bruce Morely Dana Peck Marci Proutt Steve Steinhour	Senior Meteorologist Manager, Avian Research and Policy Development Turbine Director Manager, Business Development Project Manager Manager, Project Development Director, Lands and Permits
KOA Campground	Gary Gaulke	Manager
Land and Water Fund	Gregg Eisenberg	Energy Analyst
Laramie Board of Realtors	Lori Dockter	Executive Officer
Laramie Regional Airport	Sonya Walker	Weather Observer
McFadden Elementary School	Jim House	Teacher
Native American Tribes		
Eastern Shoshone	--	--
Lower Brulé Sioux	--	--

Table 6.1 (Continued)

Agency or Organization	Individual	Position
Minneconjous Sioux	--	--
Northern Arapaho	--	--
Northern Cheyenne	--	--
Oglala Lakota Nation	--	--
White River Ute	--	--
Native Ecosystems Council and Friends of the Bow	Leila Stanfield Donald Duerr	Member Member
Nature Conservancy/Wyoming Natural Diversity Database	Chris Garber Mary Neighbours	Research Zoologist Information Manager
PacifiCorp, Inc.	Ted Huss Dale Raugutt	Region Land Agent Electrical Engineer
Raptor Research and Technical Assistance Center, Boise State University	Mark Fuller	Raptor Biologist
Sacramento Municipal Utility District	Paul Olmstead	Senior Project Manager
Sintek Realty	Chris Fournier	Realtor
South Dakota State University	Kenneth Higgens	Biologist
Steve Schaffer's Outfitters	Steve Schaffer	Owner
University of Colorado	Tamara Holmes	Biologist
University of Wyoming		
Atmospheric Sciences Department	Derek Montague John Morwitz	Professor Professor
Botany Department	Ron Hartman	Curator, Rocky Mountain Herbarium
Geology Department	Jason Lillegraven	Paleontologist
Geology Museum	Brent Breithaupt	Museum Curator/Paleontologist
U.S. Fish and Wildlife Service	Steve Brockman Charles P. Davis Wally Jobman Bob Prieksat	Fish and Wildlife Biologist State Supervisor Wildlife Biologist Special Agent
Western Ecosystems Technology Co.	Wally Erickson Dale Strickland	Biometrician Vice President
Wise Agency	Henry Hewitt	Broker
Wyoming Cooperative Research Unit	Loren Ayers Linda Kerley	Research Assistant Research Associate

Table 6.1 (Continued)

Agency or Organization	Individual	Position
Wyoming Department of Commerce	Fred Chapman	State Historic Preservation Office
	John T. Keck	State Historic Preservation Office
	Judy Wolf	State Historic Preservation Office
Wyoming Department of Employment	Mike Paris	Statistician
	Carol Kennedy	Employment Program Consultant
Wyoming Department of Environmental Quality	Gary Beach	Division Administrator
	Charles Collins	Administrator
	Vanessa Forselius	Senior Economist
	Dennis Hemmer	Director
	Bob Schick	Air Quality Analyst
	John Wagner	Technical Supervisor
Wyoming Department of Revenue, Excise Tax Division	Don Bright	Policy Analyst
Wyoming Department of Transportation	Spence Garrett	State Planning Engineer
	John Lane	Systems Planning Engineer
	Adam Uhrich	Transportation Survey Supervisor
Wyoming Division of Economic and Community Development	Ann McGowan	Librarian
Wyoming Employment Security Administration	Gordon Wolford	Statistician
Wyoming Game and Fish Department	Andrea Cerovski	Nongame Bird Biologist
	Richard Guenzel	Wildlife Biologist
	Greg Hiatt	Wildlife Biologist
	Patrick Hnilicka	Wildlife Biologist
	Bob Luce	Nongame Mammal Biologist
	Don Miller	Area Fishery Supervisor
	Bob Oakleaf	Nongame Coordinator
	Francis Peters	Director
	Reg Rothwell	Staff Biologist
	Steve Tessman	Environmental Biologist
	Tim Thomas	Wildlife Biologist
	Joe White	Deputy Director
	Pat White	Environmental Biologist
Wyoming Geological Survey	James Case	Geologist
	Gary Glass	State Geologist
Wyoming State Board of Equalization	Tom Roberts	Executive Secretary

Table 6.2 List of Preparers and Participants.

Name	Education/Experience	EIS Responsibility
BLM INTERDISCIPLINARY TEAM		
Mary Apple	B.S. Social Science; 11 years professional experience	Public Affairs
Tim Bottomley	B.S. Forest Management; 15 years professional experience	Environmental Coordinator
Missy Cook	A.A.S.; 7 years professional experience	Clerical, Environmental Coordinator
Gary DeMarcay	M.S. Anthropology, B.S. Anthropology; 21 years professional experience	Cultural Resources
Bev Derringer	15 years professional experience	Public Involvement
Susan Foley	B.S. Range Management; 5 years professional experience	Soils and Watershed
Walt George	M.S. Ecology, B.S. Wildlife Management; 18 years professional experience	Team Leader
Ray Hanson	B.S. Environmental Resources; 20 years professional experience	Recreation, Visual Resources
Cheryl Hicks	M.S. Range Science; 4 years professional experience	Land Use
Larry Jackson	B.S. Range Management; 20 years professional experience	Environmental Compliance
Dick Larsen	M.S. Soils, B.S. Forestry; 24 years professional experience	Hazardous Materials
Mark Newman	B.S. Geology; 16 years professional experience	Geology and Hydrology
Tom Rinkes	B.S. Wildlife Resources; 16 years professional experience	Wildlife
Marilyn Roth	15 years professional experience	Public Involvement
Bob Tigner	Ph.D. Environmental Biology, M.S. Wildlife Management, B.S. Game Management; 34 years professional experience	Assistant Team Leader

Table 6.2 (Continued)

Name	Education/Experience	EIS Responsibility
MARIAH ASSOCIATES, INC.		
Karyn C. Classi	M.S. Botany, M.S. Geology, B.A. Geology; 11 years professional experience	Project Management, Project Description, Physical Resources, Visual Resources
Genial G. DeCastro	B.S. Business Administration; 15 years professional experience	Technical Editing, Document Production
William Glenn	B.S. Agronomy, 28 years professional experience	Soils Scientist
Peter J. Guernsey	M.S. Range Management (pend.), B.S. Biology; 11 years professional experience	Quality Assurance
William M. Harding	M.A. Anthropology (pend.), B.A. Anthropology; 9 years professional experience	Cultural Resources
Carolyn W. Hayden	B.S. Animal Science; 12 years professional experience	Document Production/Coordination
Kelly M. Heinrich	6 years professional experience	Document Production/Coordination
Gary L. Heller	M.S. Zoology and Physiology, B.S. Wildlife Management; 7 years professional experience	Wildlife, Land Use, Socioeconomics, Hazardous Materials
Jonathan Hughes	M.S. Botany, B.S. Natural Resources, 4 years professional experience	Vegetation, Land Use
Heinz Jacobs	39 years professional experience	AutoCad
Patricia Kennedy	Ph.D. Zoology, M.S. Zoology, B.A. Biology; 16 years professional experience	Avian Wildlife
Craig L. Kling	M.S. Wildlife Biology, B.A. Ecology and Wildlife; 19 years professional experience	Quality Assurance, Project Management
Tamara Linse	3 years professional experience	Document Production/Coordination
Marion Maderak	M.S. Geological Engineering, B.S. Geology, 35 years professional experience	Physical Resources
Jason Marmor	M.A. Public History and Historic Preservation, B.A. Cultural Anthropology, 6 years professional experience	Historical Resources

Table 6.2 (Continued)

Name	Education/Experience	EIS Responsibility
Richard McGuire	M.S. Zoology, B.S. Wildlife and Fisheries Biology; 19 years experience	Quality Assurance
Ed Schneider	M.A. Anthropology, B.A. Anthropology; 10 years professional experience	Cultural Resources
Roger A. Schoumacher	B.S. Wildlife Management, M.S. Fisheries; 30 years professional experience	Quality Assurance
Craig S. Smith	M.A. Anthropology, B.A. Anthropology; 17 years professional experience	Cultural Resources
Diane Thomas	M.S. Zoology and Physiology, B.S. Wildlife Management, 5 years professional experience	Avian Wildlife
Joni Ward	M.S. Fishery and Wildlife Biology (pend.), B.S. Fishery and Wildlife Biology; 7 years professional experience	Avian Wildlife
BROWN-BUNTIN ASSOCIATES, INC.		
Paul Bollard	B.S. Mechanical Engineering; 7 years professional experience	Noise
TABLER AND ASSOCIATES		
Ron Tabler	M.S. Watershed Management, B.S. Watershed Management; 35 years professional experience	Snow

7.0 REFERENCES, ABBREVIATIONS, AND ACRONYMS

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7.2 ABBREVIATIONS AND ACRONYMS

3C	Category 3 Candidate
ac	Acre(s)
AC	Alternating current
ACHP	Advisory Council on Historic Preservation
AFDC	Aid to Families with Dependent Children
Alternate	Alternate transmission line route
ANSI	American National Standards Institution
AO	Authorized officer
ASTM	American Society for Testing and Materials
AUM	Animal unit month
AWEA	American Wind Energy Association
BA	Biological assessment
bbls	barrels
BEPA	Bald Eagle Protection Act
BFF	Black-footed ferret
BLM	Bureau of Land Management
BPA	Bonneville Power Administration
C1	Category 1 Candidate
C2	Category 2 Candidate
$CaCO_3$	Calcium carbonate
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
C.F.R.	Code of Federal Regulations
cf	Cubic feet
cfs	Cubic feet per second
CO	Carbon monoxide
CO_2	Carbon dioxide
COE	U.S. Army Corps of Engineers
Council	Northwest Power Planning Council
dBA	A-weighted decibel(s)
DEIS	Draft EIS
ECC	Environmental Compliance Coordinator
EIS	Environmental Impact Statement
EMF	Electric and magnetic fields
ENM	Environmental Noise Model
EPA	Environmental Protection Agency
ESA	Endangered Species Act
EWEB	Eugene Water and Electric Board
FCR	Foote Creek Rim
FCRA	Foote Creek Rim area
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FICON	Federal Interagency Committee on Noise
ft	Feet
gal	Gallon(s)

GDRA	Great Divide Resource Area
gpm	Gallons per minute
HMMP	Hazardous Materials Management Plan
HMP	Habitat Management Plan
hr	Hour(s)
I-80	Interstate Highway 80
IDT	Interdisciplinary Team
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
IRP	Integrated Resource Plan
KENETECH	KENETECH Windpower, Inc.
km	Kilometer(s)
KOP	Key observation point
KPPA	KENETECH/PacifiCorp Project Area
kV	Kilovolt(s)
kW	Kilowatt(s)
kWh	Kilowatt hour(s)
LOP	Life-of-project
l	Liter(s)
lbs/ac	Pounds per acre
m	Meter(s)
m/s	Meter(s) per second
min	Minute(s)
Mariah	Mariah Associates, Inc.
MBTA	Migratory Bird Treaty Act
mcf	Thousand cubic feet
μg	Micrograms
mg	Milligrams
mG	Milligauss
mi	Mile(s)
mmcf	Million thousand cubic feet
mph	Miles per hour
MW	Megawatt(s)
N_2O	Nitrous oxide
NEMA	National Electrical Manufacturer's Association
NEPA	National Environmental Policy Act
NESC	National Electric Safety Code
NETA	National Electrical Testing Association
NMHC	Non-methane hydrocarbon
Northwest Power Act	Pacific Northwest Electric Power Plan and Conservation Act
NO_x	Nitrogen oxide
NRHP	National Register of Historic Places
NTP	Notice to Proceed
NWI	National Wetlands Inventory
O&M	Operations and maintenance
ORV	Off-road vehicle
OSHA	Occupational Safety and Health Act
PacifiCorp	PacifiCorp, Inc.

PCB	Polychlorinated biphenyls
pCi/l	Picocuries per liter
PM10	Particulates ≤10 microns
PMZ	Primary Management Zone
POD	Plan of Development
PPM	Parts per million
PSCo	Public Service Company of Colorado
PSD	Prevention of significant deterioration
RCA	Raptor concentration area
RFP	Request for proposals
RMP	Resource Management Plan
ROD	Record of Decision
ROW	Right-of-way
RSEP	Resource Supply Expansion Program
RV	Recreational vehicle
SARA	Superfund Amendments and Reauthorization Act
SCS	Soil Conservation Service
SD	Standard deviation
SHPO	Wyoming State Historic Preservation Office
SI	Shut in
SMUD	Sacramento Municipal Utility District
SO_2	Sulphur dioxide
SPCCP	Spill Prevention Control and Countermeasure Plan
SPPP	Stormwater Pollution Prevention Plan
SRA	Simpson Ridge area
T&E	Threatened and endangered
TCP	Traditional Cultural Property
TDS	Total dissolved solids
TEC&S	Threatened, endangered, candidate or state sensitive
Tri-State	Tri-State Generation and Transmission Company
TSP	Total suspended particulates
TV	Television
UBC	Unified Building Code
UP	Union Pacific
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VRM	Visual resource management
WDEQ	Wyoming Department of Environmental Quality
WDEQ-AQD	Wyoming Department of Environmental Quality-Air Quality Division
WDEQ-WQD	Wyoming Department of Environmental Quality-Water Quality Division
WEST	Western EcoSystems Technology, Inc.
WESTERN	Western Area Power Administration
WGFD	Wyoming Game and Fish Department
WGS	Wyoming Geological Survey

Wick Unit	Wick Brothers Wildlife Habitat Management Unit
Windplant™	Windpower plant
WNDD	Wyoming Natural Diversity Database
WOGCC	Wyoming Oil and Gas Conservation Commission
WRA	Wind resource area
WTG	Wind turbine generators