CHAPTER 2: PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

This chapter presents information concerning the Applicant, Sagebrush Power Partners LLC, and describes the proposed KVWPP. The KVWPP description includes information regarding the project site and location, project facilities, safety features and control systems, construction activities and costs, operations and maintenance activities, decommissioning activities, and mitigation measures inherent in the design. Also described are alternatives considered by the Applicant but eliminated from detailed evaluation, offsite alternatives, the No Action Alternative, and benefits or disadvantages for reserving project approval for a later date. The information presented in this section is primarily based on information provided by the Applicant in the ASC (Sagebrush Power Partners LLC 2003a, Sections 2.1, 2.3, 2.4, 2.12, 2.14, 2.16, and 9.1), in the Applicant's October 2005 KVWPP Project Development Activities Application to Kittitas County (Sagebrush Power Partners LLC 2005), and in the Applicant's Second Request for Preemption submitted to EFSEC (Sagebrush Power Partners LLC 2005a). Additional information used to evaluate the potential impacts has been referenced.

Rules published under SEPA require that this EIS describe the proposal and alternative courses of action. Reasonable alternatives include actions that could feasibly attain or approximate a proposal's objectives, but at a lower environmental cost or decreased level of environmental degradation. The rules also require that the impacts of these alternatives be compared with the impacts of not implementing the alternatives (No Action) and that the advantages and disadvantages of delaying the approval for some future date be discussed. As this chapter explains, alternative wind energy technologies and an alternative project layout were considered in developing and siting the wind turbine towers. These alternatives, however, were eliminated from further study because they either did not meet the proposal's objectives, were not practical or feasible, or would result in higher environmental costs (compared to the proposed action).

Two of six offsite alternatives originally considered in the Draft EIS have been carried forward for further evaluation as part of this Final EIS. Therefore, this EIS evaluates the potential impacts of the Kittitas Valley Wind Power Project and its associated facilities (the proposed action) as described in this chapter, two offsite alternatives, and the No Action Alternative.

2.1.1 The Applicant

The Applicant for the Kittitas Valley Wind Power Project is Sagebrush Power Partners LLC, a wholly owned subsidiary of Horizon Wind Energy. Sagebrush Power Partners was created as a Delaware limited liability company for the sole purpose of developing, permitting, financing, constructing, owning, and operating the Kittitas Valley Wind Power Project. Sagebrush Power Partners LLC will own and operate the project and manage all of the facility's affairs, including obtaining permits and other approvals required for project development.

In mid 2005, Goldman Sachs purchased Zilkha Renewable Energy, and changed the company name to Horizon Wind Energy (Horizon Wind Energy 2005). A partial list of other wind power projects developed, under construction, or planned in the near term by Zilkha Renewable

Energy/Horizon Wind Energy include the following (Taylor, pers. comm., 2003; Horizon Wind Energy 2006a, 2006b):

Completed projects

- 1999: Tierras Morenas, Costa Rica (24 MW);
- 2001: Somerset and Mill Run, Pennsylvania (24 MW);
- October 2001: Top of Iowa Wind Farm, Iowa (80 MW);
- 2003: Pine Tree Wind Project, California (120 MW);
- Summer 2003: Meyersdale Wind Energy Center, Pennsylvania (30 MW);
- December 2003: Blue Canyon Wind Farm, Oklahoma, (75 MW);
- December 2005 – January 2006: Maple Ridge Wind Farm, New York (300 MW);
- Purchased in 2005: Madison Wind Farm, New York (11.5 MW);
- December 2006: Wild Horse Wind Power Project, Washington (229 MW).

Projects under construction (expected date of completion)

- Early 2007: Lone Star Wind Farm, Texas (400 MW);
- Spring 2007: Elkhorn Wind Farm, Oregon (101 MW);
- December 2007: Twin Groves Wind Farm, Illinois (396 MW).

Projects under development

- Cloud County Wind Farm, Kansas (200 MW);
- Spring 2007: Marble River Wind Farm, New York (218 MW);
- Spring 2008 to December 2008: Blackstone Wind Farm, Illinois (600 MW);
- 2008: Dairy Hills Wind Farm, New York (120 MW).

2.1.2 Scope of this EIS

The scoping phase of the EIS process was completed on March 14, 2003. Based on the comments received and information compiled during the scoping phase, EFSEC, the SEPA lead agency, determined that the scope of this EIS consists of a description of the proposed action and alternatives; a discussion of the affected environment; an evaluation of the project's potential direct, indirect, and cumulative impacts; and an identification of suitable mitigation measures associated with the construction, operation, maintenance, and decommissioning of all components (and connected actions) of the proposed project, including the turbines, electrical collector infrastructure, substations, access roads, operations and maintenance facility, and meteorological towers.

In evaluating potential impacts from construction and operation of these components and connected actions, the following elements of the natural and built environment are addressed in this EIS:

- Earth Resources;
- Vegetation, Wetlands, Wildlife and Habitat, Fisheries, and Threatened and Endangered Species;
- Water Resources;
- Health and Safety;
- Energy and Natural Resources;
- Land Use and Recreation;
- Socioeconomics;
- Cultural Resources;
- Visual Resources;
- Transportation;
- Air Quality;
- Noise;
- Public Services and Utilities.

2.2 DESCRIPTION OF PROPOSED ACTION

2.2.1 Project Overview

Sagebrush Power Partners LLC proposes to construct and operate a series of wind turbines that would harness the natural wind at the proposed Kittitas Valley Wind Power Project site in Kittitas County, Washington. Energy from the spinning turbines will be turned into approximately 97 to 195 megawatts of power, which would be sold through long term power purchase contracts. Although these contracts have been proposed to a number of local and regional utilities, as of the time this Final EIS was published no contracts had been negotiated or executed. Elements of the project include wind turbine generators, roads, foundations, underground and overhead electrical lines, grid interconnection facilities, one or two substations, an operations and maintenance (O&M) facility, and associated supporting infrastructure and facilities. Figure 2-1 illustrates the general site layout of these key elements, and a turbine layout representative of the largest turbines that could be selected (see below). Project construction could begin in the spring of 2007 immediately after obtaining site certification from EFSEC, and it is anticipated that it would take approximately one year to construct the facility. The expected service life of the facility is 20 years. Refer to Section 2.2.6 for details addressing upgrade of older equipment with more efficient turbines (repowering) after the initial 20-year period.

The project would install three-bladed wind turbines on tubular steel towers ranging approximately in size from 1.5 MW to 3 MW (generator nameplate capacity) in the project area.

The final selection of the exact make and model of wind turbine to be used for the project depends on a number of factors including equipment availability at the time of construction. The number of turbines and the resulting nameplate capacity of the project would depend on the type of technology used. In addition, since the time the environmental analysis was originally started for this project, the nominal capacity of wind turbines currently on the market no longer directly correlates with their physical dimensions (Taylor 2006). Therefore, to capture a "reasonable range" of potential project impacts, this EIS defines and evaluates the following proposed action scenarios:

- 330-foot Turbine Scenario: This scenario represents the project configuration that would be chosen based on pricing and performance for wind turbine technology currently on the market. Up to 65 turbines would be constructed. This scenario is best represented by turbines with a nameplate capacity of approximately 1.5 to 2 MW, resulting in a total nameplate capacity of 97.5 to 130 MW;
- 410-foot Turbine Scenario: This scenario represents the project configuration with the largest dimension of proposed turbines, not to exceed a tip height of 410 feet. With an approximate nameplate capacity of 3 MW each, up to 65 turbines would be constructed for a total approximate nameplate capacity of 195 MW.

Figure 2-2 illustrates the maximum dimensions not be exceeded of the range of the proposed action scenarios. For comparison purposes, Figure 2-2 also depicts, to scale, a Bonneville transmission tower that presently occupies the project area.

Tables 2-1 and 2-2 summarize the proposed project facilities and the total temporary and permanent area occupied by the project elements for the two action scenarios. The permanent project footprint (for the life of the project) would occupy approximately 108 acres for wind turbines, access roads, substations, and other facilities. Approximately 211.2 acres would be temporarily occupied during construction by facilities such as staging areas and equipment laydown areas. Turbines greater than 1.5 MW require wider 34-foot wide roads between individual turbines to accommodate larger construction cranes. The amount of land disturbance required for the operations and maintenance facility, substations, and meteorological towers would not change depending on the size of turbine selected.

Up to 65 turbines would be arranged in "strings" labeled A through J throughout the project site, for a maximum of 23 total miles of turbine strings (Figure 2-1). The length of the 9 turbine strings would remain constant under the two proposed action scenarios. The height of the turbines (referred to as the "tip height") would range from about 330 feet, not to exceed 410 feet from the ground to the blade tip in its highest position, depending on the turbine size selected (see Figure 2-2). In any scenario chosen by the Applicant only a single size of turbines would be used throughout the project; different sizes of turbines would not be mixed.

To access and service the wind turbines and other facilities at the site, up to 8 miles of existing private roads would be improved, and up to 13 miles of new access roads would be constructed. One O&M facility, approximately 5,000 square feet on a 5-acre site, also would be constructed. Electrical lines would be installed to connect the turbines and strings (see Figure 2-1). Lines connecting individual turbines in each string would be located underground, and lines connecting the strings primarily would be underground with some overhead.

Figure 2-1

Figure 2-2

2.2.2 Project Location and Project Site

The project site is located on open ridgetops between Ellensburg and Cle Elum, about 12 miles northwest of the City of Ellensburg in Kittitas County, Washington. The estimated 108-acre project site lies within an area covering approximately 3.5 miles (east-west) by 5 miles (north-south). For purposes of this EIS, the terms “project site” and “project area” are defined as follows:

- Project site: Actual locations within the project area where construction and operation activities would occur. As shown in Tables 2-1 and 2-2, below, the size of the project site depends on the project phase (i.e., construction vs. operations) and the proposed action scenario;
- Project area: The general area that surrounds the project site; this includes the tax parcels where all project facilities are proposed.

Project site ridges rise as high as 1,300 feet above the surrounding valley floor. Strong northwest winds in the project area are compressed as they pass by Lookout Mountain and are further accelerated as they pass over the site’s ridgetops. The center of the site is located approximately at the intersection of the main Bonneville and PSE east-west transmission line corridors with US 97.

Table 2-1: Permanent Disturbance Footprint for Range of Proposed Turbines

Facilities	**Number**	**Approximate Footprint Area (total acres)**	
		330-foot Turbine Scenario	**410-foot Turbine Scenario**
Project site roadways[1]	Existing: 8 miles New: 13 miles	82.6	82.6
Turbines and crane pads[2]	up to 65	4.4	4.4
O&M facility with parking	1	5	5
Overhead line pole footprint	50	0.25	0.25
Step up substation	2	6	6
Turn-around areas	18	9	9
Meteorological towers	Up to 5[3]	0.42	0.42
Total Footprint (acres)		108	108

Source: Sagebrush Power Partners LLC 2003e; Brown 2006; Sagebrush Power Partners LLC 2006b.

1 6.06 miles of road at 24 feet wide, and 14 miles of road at 38 feet wide (with additional 4 feet allowed for underground utility trenches on all roads).

2 0.066 acres of permanent disturbance is required per turbine for crane pads.

3 The Applicant further committed to installing up to 5 meteorological towers in its final adjudicative briefs submitted to EFSEC.

Table 2-2: Temporary Disturbance Footprint for Range of Proposed Turbines

Facilities	Approximate Footprint Area (total acres)	
	330-foot Turbine Scenario	410-foot Turbine Scenario
Disturbance beside roads[1]	49.4	49.4
Laydown area at turbines[1]	134.3	134.3
Material laydown area at substation	5	5
Meteorological tower temporary footprint	3.7	3.7
Temporary overhead line pole footprint	8.8	8.8
Temporary area at O&M facility	10	10
Total Footprint (acres)	211.2	211.2

Source: Sagebrush Power Partners LLC 2003e; Brown 2006.

[1] 20-foot wide roads require a temporary disturbance of 40 feet wide; 34-foot wide roads require a temporary disturbance of 60 feet wide.

[2] 2.066 acres of permanent disturbance is required per turbine for laydown area.

Under either the 330- or 410-foot turbine scenarios wind turbines would be installed along the roadways shown in Figure 2-1. The layout design shown in Figure 2-1 is based on 410-foot high wind turbines with a rotor diameter of approximately 295 feet. Because of possible variances that may be discovered during the final site survey, some flexibility in determining the exact facility locations is required. Generally, it will not be necessary to relocate roads significantly from their proposed locations; however, the exact location of the turbines along the planned roadways may need to be altered from the plan shown in Figure 2-1 because of a number of factors including:

- The results of geotechnical investigations to be conducted at each surveyed turbine location may reveal underground voids or fractures. In this case, the turbine location may need to be altered or eliminated;.
- The final onsite field survey with the meteorologists may dictate that turbines be spaced slightly closer together in some areas and farther apart in other areas;
- If, at the time of construction, a turbine with a larger rotor diameter is to be used (i.e., under the 410-foot turbine scenario), the turbine spacing would be increased. Conversely, if a turbine with a smaller rotor diameter is to be used (i.e., under the 330-foot turbine scenario), turbine spacing would be decreased;
- The final field measurement test surveys of communication microwave paths may require that some turbine locations be adjusted slightly to avoid line-of-sight interference.

Given that rotor diameters proposed for the wind turbines would range from approximately 230 feet to 295 feet, turbines would not vary from their proposed locations by more than 350 feet. Adjustments to final turbine tower locations would take into account set backs to roads, powerlines, property lines of nonparticipating landowners, or residences.

Figure 2-1 shows property ownership at the time the Applicant submitted their Development Activities Application to Kittitas County (Sagebrush power Partners LLC 2005). Table 2-3 identifies new property owners in the KVWPP area since original issuance of the Draft EIS in December 2003.

Table 2-3: Property Ownership Changes in KVWPP Area (as of November 2006)

Location	Previous Owner	New Owner
T19, R17, Section 1	Brooke	Aronicha
T19, R17, Section 1	Creech	Brinkman
T19, R17, Section 2	Mathias	Oberhamsley
T19, R17, Section 2	Sambrano	Morraitis
T19, R17, Section 3	Burke	Ranch on Swauk Creek
T19, R17, Section 4	Archambeau	The Henley Group (7 Parcels)
T19, R17, Section 4	Archambeau	P Ahles
T19, R17, Section 4	Archambeau	W Fitzgerald
T19, R17, Section 4	Archambeau	T Yeager
T19, R17, Section 4	Archambeau	R Thayer (4 Parcels)
T19, R17, Section 4	Brett	Bisnett
T19, R17, Section 9	Brett	Bisnett
T19, R17, Section 9	Archambeau	The Henley Group (6 Parcels)
T19, R17, Section 9	Archambeau	C Holtz
T19, R17, Section 9	Boyd & Twogood	A Stafford
T19, R17, Section 9	Boyd & Twogood	Nelsen Creek Visions
T19, R17, Section 9	Zeller	Shorett
T19, R17, Section 9	Estes	Arriola
T19, R17, Section 9	Taylor	WB Bell (2 Parcels)
T19, R17, Section 12	Pentz	Gabrielson
T19, R17, Section 12	Gagnon	Henry
T19, R17, Section 12	Best	Schaut
T19, R17, Section 12	Gorski	Littlejohn
T19, R17, Section 13	Vlasic	Kirchman
T19, R17, Section 13	Gallagher/Steinman	E. Garrett
T19, R17, Section 13	Garrett	C. Wilkins
T19, R17, Section 14	Los Abuelos	Whiteley
T19, R17, Section 14	Los Abuelos	M Miller
T19, R17, Section 14	Los Abuelos	Romero
T19, R17, Section 14	Steinman/Giesick	Thompson
T19, R17, Section 15	Los Abuelos	D. Smith
T19, R17, Section 15	Los Abuelos	L Storwick
T19, R17, Section 15	Los Abuelos	Mark Miller
T19, R17, Section 15	Los Abuelos	Ackerson
T19, R17, Section 15	Los Abuelos	Romero
T19, R17, Section 22	Schober	Sage Brush Power Partners
T19, R17, Section 23	Bowman	Whiteley
T19, R17, Section 23	Kimbler	Blume
T19, R17, Section 23	Price	Hawley
T19, R17, Section 26	Anderson	Olsen
T19, R17, Section 26	Brennan	Freeman
T19, R17, Section 26	Clayburn	Brown
T19, R17, Section 26	Heistand	Char
T19, R17, Section 26	Heistand	Kinsman
T19, R17, Section 26	Rhoden	McGrew
T19, R17, Section 26	Letson	Lewis
T19, R17, Section 27	Schober	170 LLC - Elliott
T19, R17, Section 27	Schober	Sage Brush Power Partners
T19, R17, Section 27	Pearson	Henson
T19, R17, Section 27	Pearson	Hevens

Source: Foote 2003; Schafer 2006a; Potter 2006.

Table 2-3 Continued

Location	Previous Owner	New Owner
T19, R17, Section 28	Pearson	Hevens (4 Parcels)
T19, R17, Section 28	Pearson	McFarland
T20, R17, Section 35	J Duncan	J Steffansson
T20, R17, Section 35	S. Oslund	P. Stewart
T20, R17, Section 35	Korthanke	T. Sween
T20, R17, Section 35	Amundson	T Shirey
T20, R17, Section 35	Gausman	R.Hawk
T20, R17, Section 35	Hershberger	P. Abson
T20, R17, Section 35	Kendig	Nelson
T20, R17, Section 35	W. Flowers	J. Hunter

Source: Foote 2003; Schafer 2006a; Potter 2006.

Project Setbacks

The minimum setbacks incorporated into the proposed project layout are based on several factors, including safety and avoidance of nuisance concerns, industry standards, and on the Applicant's experience in operating wind power projects. Some are fixed distances (i.e., 1,000 feet) that are based on estimates or modeling of potential nuisance impacts such as noise and shadow-flicker. Others, such as tip height, relate to the size of the actual turbines to be installed (see Figure 2-2). (Tip height refers to the total distance from the base of the turbine to the tip of the blade at its highest point.) Tip height setbacks are primarily safety-related (e.g., if an entire tower and turbine were to collapse from a massive earthquake and/or hurricane force wind, they would not fall on a public road or a neighbor's property). The proposed setbacks for the project's proposed turbine towers are as follows (Sagebrush Power Partners LLC 2003c, Section 2.3.12; 2006a; 2006b):

- Setback from residences of neighboring landowners (i.e., those without signed agreements with the Applicant): 1,320 feet;
- Setback from property lines of neighboring landowners: 541 feet beyond the tip of the blade at its closest point to the property line;
- Setback from county/state roads: Turbine tip height;
- Setback from residences with signed agreements with the Applicant: At least blade tip height. However, it may be less, based on the property owner's approval. Some landowners want to have turbines closer than 1,000 feet to their residence in exchange for more turbines on their land and the revenue generated by them;
- Setback from property lines of landowners with signed agreements with the Applicant: None. All property owners with signed agreements with the Applicant have agreed to a zero setback from property lines, as this allows the most efficient and lowest impact of wind turbines on various landowners' property;
- Setback from Bonneville/PSE transmission lines: Blade tip height.

Minor adjustments would be made to the proposed project layout such as moving the turbine tower foundations to maintain the setbacks described above. The proposed setback for the meteorological towers from public roads and residences is tip height. There are no designated setbacks for the other project components such as the O&M facility, substations, and gravel access roads.

2.2.3 Facilities

The project would be located on privately-owned open rangeland and rangeland owned by DNR pursuant to leases negotiated between the landowners and the Applicant. These leases would allow construction and operation of wind facilities for a negotiated term. In exchange, each landowner leasing property would receive financial compensation.

The project would consist of wind turbines, associated electrical systems (including an electrical collector system, substations, and interconnection facilities), meteorological towers, access roads, and an operation and maintenance building (see Figure 2-1). Each of these features is described in more detail below.

Wind Turbines

Wind turbines consist of three main components: the turbine tower, nacelle, and rotor blades. A typical wind turbine tower is shown in Figure 2-3. The nacelle is the portion of the wind turbine mounted at the top of the tower, which houses the wind turbine itself, the rotor, hub, and gearbox (Figure 2-4). The 1.5- to 3-MW wind turbines under consideration for the project have the design features shown in Table 2-4.

Table 2-4: Wind Turbine Features, Kittitas Valley Wind Power Project

Design Feature	Description	
	330-foot Turbine Scenario	410-foot Turbine Scenario
Rated output of turbine	1.5 MW	3 MW
Number of turbines	65	65
Axis	Horizontal	Horizontal
Rotor orientation	Upwind	Upwind
Minimum wind speed for turbines to begin operating	7-10 miles per hour[1]	7-10 miles per hour[1]
Number of blades	Three	Three
Rotor (blade) diameter	231 feet	295 feet
Tower type	Tubular steel	Tubular steel
Tower hub (nacelle) height	215 feet	265 feet
Total (tip) height (to top of vertical rotor)	330 feet	410 feet
Rotational speed	10-23 rotations per minute	17-20 rotations per minute
Nacelle	Fully enclosed steel or steel reinforced fiberglass	Fully enclosed steel or steel reinforced fiberglass
Color	Neutral gray	Neutral gray

Source: Sagebrush Power Partners LLC 2003a, 2005, 2006a, 2006b.

[1] Wind turbines rotate in winds as low as 2-3 mph, but generator cut-in occurs at 7-10 mph.

Towers

Towers would be approximately 215 to 263 feet tall at the turbine hub (referred to as the “hub height”). With the nacelle and blades mounted, the total height of the wind turbine (“tip height”) would be approximately 330 to 410 feet with a blade in the vertical position. The towers would be a tubular conical steel structure manufactured in multiple sections depending on the tower height and approximately 12 to 16 feet in diameter at the base. The towers would be painted a neutral gray color to be visually less obtrusive. A service platform at the top of each section would allow for access to the tower’s connecting bolts for routine inspection. A ladder inside the structure would ascend to the nacelle to provide access for turbine maintenance. The tower would be equipped with interior lighting and a safety glide cable alongside the ladder.

The towers would be fabricated and erected in two to three sections. Turbine tower sections would be transported to the site on trailers that could each carry one tower section per truck. Tower sections would be delivered by truck to a staging area and then to each tower location. They would be erected using a large construction crane.

Nacelle

The nacelle houses the main mechanical components of the wind turbine generator—the drive train, gearbox, and generator. The nacelle would be equipped with an anemometer and a wind vane that signals wind speed and direction information to an electronic controller. A mechanism would use electric motors to rotate (yaw) the nacelle and rotor to keep the turbine pointed into the wind to maximize energy capture. An enclosed steel-reinforced fiberglass shell houses the nacelle to protect internal machinery from the elements.

Rotor Blades

Modern wind turbines have three-bladed rotors. The diameter of the circle swept by the blades would range from approximately 230 to 295 feet (that is, each blade would be approximately 115 to 150 feet long). The blades would turn at about 10 to 23 rotations per minute (RPM). Newer turbines representative of those considered for the 410-foot turbine scenario turn at about 17 to 20 RPM. Generally, larger wind turbine generators have slower rotating blades, but the specific RPM values depend on aerodynamic design and vary across machines. The rotor blades would be typically made from glass-reinforced polyester composite.

Electrical System

The project’s electrical system would have two key elements: (1) a collector system, which would collect energy at between 575 and 690 volts (V) from each wind turbine (depending on the type of turbine used), increase it to 34.5 kilovolts (kV) through a pad-mounted transformer, and connect to the project substations; and (2) the substations and interconnection facilities, which would transform energy from the collection lines (at 34.5 kV) to the transmission level (230 kV for the PSE line and Bonneville’s Columbia to Covington line or 287 kV for Bonneville’s Grand Coulee to Olympia line). A schematic of the electrical collection system and interconnection facilities is shown in Figure 2-5.

Figure 2-3

Figure 2-4

Figure 2-5

Collector System

Power from the wind turbines would be generated at 575 V to 690 V depending on the type of wind turbine used for the project. A set of heavy gauge, armored, flexible drop cables would connect to the generator terminals in the nacelle and would pass from the nacelle into the tower where they would drop down to a cable support saddle located about 20 to 30 feet below the top tower platform. From the support saddle, the cables would be directed along the side of the tower, along the internal ladder in cable trays, or they would be hung straight down to the base bus cabinet and breaker panel inside the base of the tower. The drop cables would terminate inside the bus cabinet. Another set of cables would run from the bus cabinet through conduits in the foundation to the pad transformer, ranging in size from 50 to 120 square feet in area; the pad transformer would step up the voltage to 34.5 kV. Some wind turbine generators, such as the Vestas V-80, have the transformer in the nacelle. For the V-80, the drop cables would be at 34.5 kV, and the base bus cabinet would be a switchgear breaker panel. Some generator models may require that the transformer be mounted on an adjacent outdoor concrete pad (Sagebrush Power Partners LLC 2003c, Section 2.3.4; Sagebrush Power Partners LLC 2005).

From the transformer, power from the turbine would be transmitted by underground 34.5-kV electrical cables installed in a trench typically 3 to 4 feet deep, depending on the underlying soil and rock conditions, and up to 3 feet wide. Multiple circuit trenches would be spaced 7 feet apart (Young 2006). Underground collection cables would be used in most areas; overhead collectors on wood structures would be used where there are steep slopes or canyons to cross (see Figure 2-1). Approximately 23 miles of underground and 2 miles of overhead 34.5-kV electrical power lines would be used to collect power from the turbines and terminate at the main substation.

An estimated 1.2-mile section of the overhead system would be along Bettas Road parallel to two existing sets of overhead transmission lines and the access road that serves them. Another overhead section is proposed to link turbine strings B and C. In the original site layout (Figure 2-1), this connection was shown as either underground or overhead. Based on subsequent input from the Washington Department of Fish and Wildlife, the Applicant proposes to build this as part of the overhead system to minimize impacts on the riparian habitat between the two ridgetops. For these short overhead portions of the electrical collection system, wooden poles, nonreflective conductors, and nonrefractive insulators would be used (Sagebrush Power Partners LLC 2003d). Overhead poles typically would be approximately 60 feet tall and positioned so that poles and electrical conductors are spaced at least 200 feet apart. The poles would be buried 8 to 10 feet deep. Pole insulators would be spaced four feet apart. Anti-perching devices would be installed on the poles to limit potential raptor use.

The electrical collection system would include junction boxes and pad-mounted switchgear panels that would be installed to connect cables coming from different directions and to allow for the isolation of particular turbine strings. In total, it is estimated that 15 junction boxes and 10 switch panels would be required for the electrical collection system (Sagebrush Power Partners LLC 2003c, Section 2.3.4).

Junction Boxes

The junction boxes would be either steel-clad or fiberglass panels mounted on pad foundations roughly 4 feet wide, 6 feet long, and 6 feet high. The pad foundation would have an underground vault about 3 feet deep where the underground cables come in. The junction boxes also would have a buried grounding ring with grounding rods tied to the collection system and a common neutral.

Switch Panels

The switch panels would be steel-clad enclosures mounted on pad foundations roughly 7 feet wide, 7 feet long, and 5 feet high. Switches would allow particular collector lines and turbines strings to be turned off or isolated. This isolation would allow maintenance and repair to take place without shutting down the entire project. The pad foundation would have an underground vault about 3 feet deep where the underground cables come in. Switch panels also would have a buried grounding ring with grounding rods tied to the collection system and a common neutral.

Substations and Interconnection Facilities

The Applicant is seeking a permit for and is designing the project so that it could interconnect with either the PSE or Bonneville electrical transmission lines traversing the site or possibly both. If connected to Bonneville's system, the project would interconnect directly with either the Grand Coulee to Olympia 287-kV line or the Columbia to Covington 230-kV line. If connected to PSE's system, the project would interconnect directly with PSE's Rocky Reach to White River 230-kV line. There is the possibility that power would be fed to both the PSE and Bonneville systems; therefore, this analysis evaluates the need to construct two substations since the lines have different voltages.

The Applicant would build and maintain up to two fenced substation sites, each occupying approximately 3 acres. The proposed PSE substation would be in the northwest corner of the intersection of US 97 and Bettas Road, and the Bonneville substation would be approximately 2,200 feet southwest of the PSE substation, south of Bettas Road near the Bonneville transmission lines. The main function of the substations and interconnection facilities would be to step up the voltage from the collection lines (at 34.5 kV) to the transmission level (230 or 287 kV) to interconnect to the appropriate utility grid. The basic elements of the substation and interconnection facilities are a control house, two main transformers, outdoor breakers, relaying equipment, steel support structures, and overhead lightning suppression conductors. All of the elements would be installed on concrete foundations designed for site-specific soil conditions.

Meteorological Towers

Meteorological towers are used to measure wind conditions, including wind speed and direction, and temperature. The Applicant proposes to erect up to five permanent meteorological towers in the project area (Sagebrush Power Partners LLC 2006). The potential proposed locations of the permanent meteorological towers is shown in Figure 2-1 (although nine locations are shown, a maximum of five towers would be constructed). The permanent meteorological towers installed for the project would be approximately as tall as the turbine tower hub height (i.e., 215 to 262 feet). The towers would be free-standing. The meteorological towers would be constructed upwind of turbine strings or groups of turbine strings to monitor wind strength and to confirm turbine performance. Meteorological towers taller than 200 feet would require lighting in compliance with the Federal Aviation Administration's (FAA) aircraft safety lighting requirements (see the lighting discussion below for further detail).

Meteorological towers would be installed with a grounding system that protects the meteorological sensors and loggers from electrostatic discharge and lightning. Lightning dissipaters or rods would be installed at the tops of the towers to provide an umbrella of protection for the upper sensors (Sagebrush Power Partners LLC 2003c, Section 2.3.8).

Access Roads

Access to the various rows of turbines would be achieved by graveled access roads branching from US 97 and two county roads—Bettas and Hayward roads. The project would improve some existing private roads and construct new gravel roads to provide access for construction vehicles and equipment. Up to approximately 8 miles of existing private roads would need to be improved and up to 13 miles of new roads would be constructed (Brown 2006). Turbines larger than 1.5 MW typically require wider 34-foot roads between the turbines to accommodate the cranes required for turbine installation. Roads between individual turbines would be 34 feet wide, but access roads between the turbine strings would be 24 feet wide. In areas of steeper grades, cut and fill slopes would be kept to below 15% to prevent erosion. After the project is constructed, use of the improved and new access roads on private lands would be limited to the landowner and to project maintenance staff.

Operation and Maintenance Facility

A permanent O&M facility would be constructed near the northwest corner of US 97 and Bettas Road. It would consist of approximately 5,000 square feet of enclosed space, including offices, spare parts storage, kitchen, restrooms, and a shop area. Water for the bathroom and kitchen would be obtained from a new domestic well; anticipated water use would be less than 1,000 gallons a day. Wastewater from the facility would be discharged to an onsite domestic septic tank. There also would be graveled outdoor parking, a turnaround area for larger vehicles, outdoor lighting, and gated access with either partial or full perimeter fencing. The overall area of the building and parking would be approximately 5 acres. Vehicle access to the O&M facility would occur from Bettas Road.

Information Kiosk

An information kiosk and public viewing area near the proposed O&M facility off Bettas Road would be constructed. Signs would be provided to direct tourists to this site (Sagebrush Power Partners LLC 2003c, Section 5.3). Vehicle access to the information kiosk and public viewing area would occur from Bettas Road at the same location as the access to the O&M facility.

Safety Features and Control Systems

Turbine Control Systems

Wind turbines would be equipped with sophisticated computer control systems that would constantly monitor variables such as wind speed and direction, air and machine temperatures, electrical voltages, currents, vibrations, blade pitch, and yaw angles. The main function of the control system would be nacelle and power operations. Generally, nacelle functions include yawing the nacelle into the wind, pitching the blades, and applying the brakes if necessary. Power operations controlled at the bus cabinet inside the base of the tower include operation of the main breakers to engage the generator with the grid as well as control of ancillary breakers and systems. The control system would always run to ensure that the machines operate efficiently and safely.

Each turbine would be connected to a central Supervisory Control and Data Acquisition (SCADA) system. The SCADA system would allow for remotely controlling and monitoring individual turbines and the wind plant as a whole from both the central host computer or from a remote personal computer. In the event of faults, the SCADA system can also send signals to a fax, pager, or cell phone to alert operations staff. The turbine towers and foundations would be designed to survive a gust of wind more than 90 miles per hour (mph) with the blades pitched in their most vulnerable position. The 100-year expected peak gust is 115 mph in the project area, and the recent maximum recorded gust is 56 mph.

Braking Systems

The turbines would be equipped with two fully independent braking systems that can stop the rotor either acting together or independently. The braking system is designed to be fail-safe, allowing the rotor to be brought to a halt under all foreseeable conditions. The system would consist of aerodynamic braking by the rotor blades and by a separate hydraulic disc brake system. Both braking systems would operate independently such that if there is a fault with one, the other can still bring the turbine to a halt. Brake pads on the disc brake system would be spring loaded against the disc, and power would be required to keep the pads away from the disc. If power is lost, the brakes would be mechanically activated immediately. The aerodynamic braking system also would be configured such that if power is lost it would be activated immediately using backup battery power or the nitrogen accumulators on the hydraulic system, depending on the turbine’s design.

After an emergency stop is executed, remote restarting is not possible. The turbine must be inspected in-person and the stop-fault must be reset manually before operation could be reactivated. The turbines also would be equipped with a parking brake used to keep the rotor stationary while maintenance or inspection is performed.

Built-in Fire Safety

Each turbine’s nacelle would be equipped with an internal fire detection system with sensors located in the nacelle as well as at the tower base. The fire detection system would be connected to the main controller and the central SCADA system. In the event of a fire, the turbine would be immediately halted and an alarm activated in the control system that can send a page or message to a cell phone of the on-call operators and/or the local fire district as required.

Climbing Safety

Normal access to the nacelle would be accomplished with a ladder inside the tower. Standard tower hardware would include equipment for safe ladder climbing including lanyards and safety belts for service personnel. Internal ladders and maintenance areas inside the tower and nacelle would be equipped with safety provisions for securing lifelines and safety belts.

Lightning Protection

The turbines would be equipped with an engineered lightning protection system that connects the blades, nacelle, and tower to a grounding system at the base of the tower. The grounding system would include a copper ring conductor connected to grounding rods driven down into the ground at diametrically opposed points outside the tower foundation. The system would provide a firm grounding path to divert harmful stray surge voltages away from the turbine. The blades would be constructed with an internal copper conductor: an additional lightning rod will extend above the wind vane and anemometer at the rear of the nacelle; both would have conductive paths to the nacelle bed frame, which in turn would connect to the tower.

Lighting

The Draft EIS explained that to comply with the Federal Aviation Administration’s (FAA) aviation safety lighting requirements, the project turbines and met towers greater than 200 feet tall must be marked with lights. The Draft EIS anticipated that white lights would be required during the day, and red lights at night (at 2,000 candela, the candela being a unit of luminous intensity). The lights would be designed to concentrate the beam in the horizontal plane, minimizing light diffusion downward toward the ground and upward toward the sky.

Under recently released guidelines, the FAA would no longer require daytime lighting of the turbines if turbines are painted a light color. Nighttime lighting would be limited to the first and last turbine of every string, and to turbines located every 1000 to 1400 feet between the ends of the strings (Patterson 2005). As a result of these FAA changes, the KVWPP would no longer install white daytime aviation warning lights, and the number of red nighttime aviation warning lights would be significantly reduced. For example, as shown in Addendum Figure 3.9-6, only 16 nighttime warning lights would be required. After it has reviewed final project plans, the FAA would specify the exact number of turbines that would require lighting.

The substations and O&M facility would be equipped with nighttime and motion-sensor lights for safety and security. Sensors and switches would be used to keep lights turned off when not required. Emergency lighting with backup power is included to allow personnel to perform manual operations during an outage of normal power sources.

2.2.4 Construction Activities

Project construction would be performed in several stages and would include the following main activities:

- Grading the field construction office and substation areas (also used for the O&M facility);
- Constructing site roads, turnaround areas, and crane pads at each wind turbine location;
- Constructing turbine tower foundations and transformer pads;
- Installing the electrical collection system—underground and overhead lines;
- Constructing and installing the substations;
- Transporting and assembling wind turbines;
- Commissioning and energizing the plant; and
- Cleaning up the site.

The Applicant intends to enter into two primary agreements for project construction including an agreement for the supply, erection, and commissioning of the wind turbines as well as an engineering, procurement, and construction (EPC) contract for all other project facilities and infrastructure such as the roads, electrical collection system, substations, and O&M facility. Table 2-5 lists the estimated type, number, and duration of construction equipment needed during project construction. These estimates would not change depending on whether the 330 or 410-foot turbine scenario is ultimately selected. (Sagebrush Power Partners LLC 2003f).

Table 2-5: Estimated Type, Number, and Duration of Project Construction Equipment

Construction Phase	Estimated Average Number of Vehicles Onsite Daily during Construction	Estimated Duration (Months)
Site Preparation and Road Construction		
Bulldozer	4	3
Dump truck	10	3
Excavator	4	3
Front end loader	4	3
Motor grader	4	3
Vibratory roller	3	3
Water truck	5	8
Foundations		
Backhoe	4	4
Crane and boom truck	3	4
Concrete pump truck	2	4
Concrete truck	8	4
Drill rig	3	4
Dump truck	6	4
Trackhoe excavator	5	4
Front end loader	3	4
Small loader	3	4
Transportation truck – materials	6	4

Source: Sagebrush Power Partners LLC 2003c

Table 2-5: Continued

Construction Phase	Estimated Average Number of Vehicles Onsite Daily during Construction	Estimated Duration (Months)
Electrical		
Cable spool truck	3	4
Concrete truck	3	4
Boom truck	2	4
Fork truck to offload spools	2	4
Man lift bucket	2	4
Rock trencher	2	4
Transportation truck – materials	8	4
Winch truck	3	4
Substation and Interconnect		
Backhoe	3	3
Bulldozer	2	3
Concrete truck	4	3
Drill rig	2	3
Dump truck	4	3
Man lift bucket truck	2	3
Trencher	2	3
Winch truck	1	3
Excavator	2	3
Wind Turbine Assembly and Erection		
Boom truck	4	4
Forklift	4	4
Rough terrain crane	4	4
Transportation truck – materials	20	4
Truck mounted crane	4	4
Project Cleanup		
Dump truck	2	2
Front end loader	2	2
Motor grader	2	2
Transportation truck - materials/waste	3	2
Daily Construction Traffic		
Minimum of 20 full size pickups, FedEx, UPS, and other delivery trucks daily	35	10

Source: Sagebrush Power Partners LLC 2003c

Field Survey and Geotechnical Investigations

Before construction can begin, a site survey would be performed to identify the precise location of the wind turbines, site roads, electrical cables, access entryways from public roads, and substation areas. Once the surveys are complete, a detailed geotechnical investigation would be undertaken to identify subsurface conditions that would dictate much of the design work of the roads, foundations, underground trenching, and electrical grounding systems. Typically, the geotechnical investigation involves a drill rig that bores to the required depths (typically 8-inch-diameter drill, 30 to 40 feet deep) and a backhoe to identify the subsurface soil and rock types and strength properties by sampling and lab testing. Testing also would be conducted to measure the soil's electrical properties to ensure proper grounding system design. A geotechnical investigation would be performed at each turbine location, at the substations, and at the O&M facility.

Design and Construction Specifications

Using data gathered for the project including geotechnical information, site specific environmental and climatic conditions, and site topography, the Applicant's engineering group would establish a set of site-specific construction specifications for various portions of the project. The design specifications would be based on established sets of construction standards set forth by standard industry practice groups such as the American Concrete Institute, Institute for Electrical and Electronic Engineers, National Electric Code, National Fire Protection Agency, and Construction Standards Institute. The design and construction specifications would be custom tailored for site-specific conditions by technical staff and engineers. The project engineering team also would ensure that all aspects of the specifications, as well as the actual on-site construction, comply with applicable federal, state, and local codes and good industry practice.

Equipment procurement would be according to the project's site specifications. The primary EPC contractor would use the design specifications as a guideline to complete the detailed construction plans for the project. The design approach ensures that the project would be designed and constructed to meet the minimum 20-year design life.

Site Preparation: Road Construction and Staging and Laydown Areas

Construction activities would begin with site preparation, including constructing project access entryways from public roads. The project roads would have a gravel surface and would be designed with a low profile without ditches to allow stormwater to pass over the top. Road construction would be performed in multiple phases starting with rough grading and leveling roadway areas. Once rough grade is achieved, base rock would be trucked in, spread, and compacted to create a road base. A capping rock would then be spread over the road base and compacted to the finished grade.

Once heavy construction is complete, a final pass would be made with the grading equipment to level out road surfaces, and more capping rock would be spread and compacted in areas where needed. Water bars, similar to speed bumps, would be cut into the roads in certain areas as needed to allow for natural drainage of water over the road surface and to prevent road washout. During grading activities, excavated soil and rock would be spread across the site to the natural grade and would be reseeded with native grasses to control erosion by water and wind. Larger excavated rocks would be disposed of offsite or crushed and reused onsite as backfill or roadway material. The Applicant does not propose to bring a rock crusher onsite, but would transport this material to the existing permitted quarry located just north of turbine F1 for crushing prior to reuse (Taylor, pers. comm., 2003).

During wind turbine installation, temporary staging and laydown areas would be required. These areas would include a 10-acre main staging area and a 5-acre material laydown area at the O&M facility location adjacent to the proposed PSE substation (Figure 2-1). These areas would be used for parking construction vehicles, construction employees' personal vehicles, and other construction equipment. Six to eight temporary office trailers powered by the existing local distribution line running along Bettas Road also would be installed at this location.

For the 330-foot turbine scenario, flat areas adjacent to each turbine location, approximately 30 feet by 60 feet (1,800 square feet), would be cleared, compacted, and laid with gravel as necessary to place turbine blades and other turbine components and to station a construction crane as each tower is erected. Wind turbine generators larger than 1.5 MW (e.g., the 410-foot turbine scenario) would require installation by a crawler crane operating on a crane pad approximately 50 feet by 100 feet (5,000 square feet). At the end of most turbine strings (except where a turbine string is adjacent to a through-traffic road), an area approximately 900 feet by 24 feet (21,600 square feet or 0.5 acres) also would be needed to allow construction equipment to turn around. After construction has been completed, laydown and staging areas would be graded and reseeded to restore the area as close as possible to its original condition.

Foundation Construction

The project would require several foundations including bases for each turbine and pad transformer, substation equipment, and the O&M facility. Once the roads are complete for a particular row of turbines, turbine foundation construction would commence on that completed road section. Foundation construction occurs in several stages including drilling, blasting, and hole excavation, outer form setting, rebar and bolt cage assembly, casting and finishing concrete, removing the forms, backfilling and compacting, constructing the pad transformer foundation, and foundation site restoration.

Foundations for the turbine towers would consist of either spread footing-type foundation design or a vertical mono-pier foundation. The specific type of foundation would be determined based on site-specific geotechnical information to be collected after project approval. The foundation design would be tailored to suit the soil and subsurface conditions at the various turbine sites. Typical dimensions for spread footing-type foundation design are shown in Table 2-6.

For the 330-foot turbine scenario, spread footing foundations would require holes approximately 100 feet by 100 feet square and about 18 feet deep. Backfill would be compacted in the bottom of the hole and reinforced square concrete footing would be poured. A reinforced concrete pedestal approximately 10 feet high would be mounted on the concrete footing to hold the tower. The concrete footing would be covered with approximately 6 to 8 feet of compacted backfill and 4 to 6 inches of topsoil depending on soil conditions.

Table 2-6: Typical Spread-Footing Type Foundation Dimensions

Element	330-foot Turbine Scenario	410-foot Turbine Scenario
Foundation Base Line	60’ x 60’	80’ x 80’
Pad Depth	8’	10’
Pedestal Height	10’	12’
Overall Depth	18’	22’
Hole Dimensions	100’ x 100’	120’ x 120’
Hole Depth	18’	22’

Source: Sagebrush Power Partners LLC 2003f.

Vertical mono-pier foundations would require excavating a hole up to 35 feet deep and up to approximately 18 feet in diameter. If the underlying rock is cohesive, competent and strong enough, rock anchors can be used which will allow the excavation to be as shallow as 15 feet deep.

The construction process for the foundations would vary depending on the foundation engineer's requirements and soil conditions found at the site. The construction process may have variances from site to site if soil conditions are different from location to location; however it generally follows the same main steps regardless of which turbine configuration is used for the project as follows:

Mono-Pier Type Foundation

- Clearing and grubbing the area with a bulldozer at the exact surveyed turbine location;
- Initial excavation of the foundation hole with a track hoe;
- Drilling and setting of charges and blasting out excavation center and perimeter simultaneously;
- Loosen rock with hydraulic jack hammer;
- Excavation of foundation hole with the track hoe;
- Installation and setting of the outer corrugated metal pipe (CMP) form and backfill or slurry into place;
- Construct the bolt cage inside the CMP;
- Insert inner CMP;
- Backfill the inner CMP with remaining suitable spoils;
- Set outer forms for tower floor and electrical conduits;
- Pour concrete into place for foundation;
- Remove forms;
- Dispose of remaining spoils;
- Restore temporarily disturbed surfaces.

Spread Footing Type Foundation

- Clearing and grubbing the area with a bulldozer at the exact surveyed turbine location;
- Initial excavation of the foundation hole with a track hoe;
- Drilling and setting of charges and blasting out excavation area center and perimeter;
- Loosen rock with hydraulic jack hammer;
- Full excavation of foundation hole with the track hoe;
- Installation and setting of the outer forms and pour concrete base mat (3-4 inches thick);
- Construct reinforcement bar (rebar) mat and pedestal anchor bolt cage;
- Assemble forms in place for pedestal, Pour concrete, allow to set and remove forms;
- Backfill the excavation;
- Set outer forms for tower floor pad and electrical conduits and pour Concrete into place for floor;
- Dispose of remaining spoils;
- Restore temporarily disturbed surfaces.

Excavation and foundation construction would be conducted in a manner that would minimize the size and duration of excavated areas required to install foundations. Portions of the work may require overexcavation and/or shoring. Foundation work for a given site would commence after excavation of the area is complete. Backfill for the foundations would be installed immediately after approval by the engineer's field inspectors. The Applicant plans to use onsite excavated materials for backfill to the extent possible. The excess excavated materials not used as backfill for the foundations would be used to level out low spots on the crane pads and roads consistent with the surrounding grade. The top soil layer of the excavated materials would be reseeded with a designated mix of grasses and/or seeds around the edges of the disturbed areas. Larger cobbles would be disposed of offsite or crushed into smaller rock at the nearby existing permitted quarry for use as backfill or road material.

Electrical Collection System Construction

Underground Cables

Once the roads, turbine foundations, and transformer pads are complete for a particular row of turbines, underground cables would be installed on that completed road section. First, a trench would be cut with a rock trencher typically 3 to 4 feet deep depending on the underlying soil and rock conditions and up to 3 feet wide. Native soils would be managed according to a specified procedure to ensure that they are retained for later restoration activities (Sagebrush Power Partners LLC 2006). Because of the rocky conditions at the site, clean fill would be placed above and below the cables for the first several inches of fill to prevent cable pinching. All cables and trenches would be inspected before backfilling. Once the clean fill covers the cables, the excavated material would be used to complete the backfilling. In areas where solid rock is encountered close to the surface, blasting would be performed or a shallower trench would be cut using rock-cutting equipment, and the cables would be covered with a concrete slurry mix to protect the cables and comply with code and engineering specifications. In areas where multiple circuit trenches of the collector system converge, trenches would be spaced 7 feet apart in order to comply with prudent engineering standards and electrical codes (Young 2006).

The high voltage underground cables would be fed through trenches and into conduits at the pad transformers at each turbine. The cables would run to the pad transformers' high voltage (34.5 kV) compartment and would be connected to the terminals. Low voltage cables would be fed through another set of underground conduits from the pad transformer to the bus cabinet inside the base of the wind turbine tower. The low voltage cable would be terminated at each end and the whole system would be inspected and tested prior to operation.

Overhead Cables

The two runs of overhead cable would require a detailed field survey to determine exact pole locations. Once the survey and design work are completed, the poles and cross-arms to support the conductors would be installed. The poles would be assembled and fitted with cross-arms, cable supports, and insulator hardware on the ground at each pole location. Holes, approximately 150 square feet (8 feet by 8 feet to 12 feet by 12 feet) in size and 8 feet to 10 feet deep for each pole, would be excavated or drilled and the poles would be erected and set in place using a small crane or boom truck. Once set in place, concrete would be poured in place or a clean fill would be compacted around the tower base according to the engineer's specifications.

Excavated soil and rock not reused in backfilling the trenches would be spread across the site to the natural grade and be reseeded with native grasses to control water and wind erosion. Larger excess excavated rocks would be disposed of offsite.

Substation and Interconnection Facility Construction

Constructing the substations and interconnection facilities would involve several stages of work including, but not limited to, grading; constructing foundations for the transformers, steel work, breakers, control houses, and other outdoor equipment; erecting the steel work and outdoor equipment; and completing electrical work for the required terminations. Once these activities are completed, an inspection and commissioning test plan would be executed prior to substation operation.

The utility (PSE or Bonneville) would be responsible for constructing the interconnection facilities because they would remain under the utility's control and jurisdiction. The high-voltage side of the substation would remain under the control of the utility and the low-voltage side of the substation would belong to the project. A fence may be installed between the high and low voltage sections to delineate control and jurisdiction, and there would likely be two control houses: one for the utility high-voltage side relaying and interconnection facilities controls and one for the project substation low-voltage side relaying and controls.

Transporting Tower Sections and Assembling Towers

The wind turbines would have three main components: towers, nacelles, and rotor blades. Other smaller components include hubs, nose cones, cabling, control panels, and internal tower facilities such as lighting and ladders. Turbine components would be delivered to the project site on flatbed transport trucks and main components would be off-loaded at the individual turbine sites. Turbine erection would be performed in multiple stages including: setting the bus cabinet and ground control panels on the foundation, erecting the tower (usually in three to four sections), erecting the nacelle, assembling and erecting the rotor, connecting and terminating the internal cables, and inspecting and testing the electrical system prior to operation.

Plant Commissioning and Energizing

Plant commissioning and energizing would occur after construction is completed and would not require the use of heavy machinery.

Erosion Control, Site Cleanup and Temporary Site Disturbance Restoration

A detailed construction Storm Water Pollution Prevention Plan (SWPPP) would be developed for the project to help minimize the potential for discharge of pollutants from the site during construction. The SWPPP would be designed to meet the requirements of the Washington State Department of Ecology's General Permit to Discharge Storm Water through its stormwater pollution control program (Chapter 173-220 WAC) associated with construction activities. The

SWPPP would include both structural and nonstructural BMPs. Examples of structural BMPs could include installing silt curtains or other physical controls to divert flows from exposed soils, or otherwise limit runoff and pollutants from exposed areas of the site. Examples of nonstructural BMPs include management practices such as materials handling and disposal requirements and spill prevention methods. The Applicant would prepare and submit a SWPPP meeting the conditions of the General Permit to Discharge Storm Water to EFSEC along with a Notice of Intent (NOI) for construction activities prior to the start of project construction.

After construction is completed, site restoration activities would consist of restoring temporarily disturbed areas as close as possible to their original condition. This excludes the service roads, which would remain in place for the life of the project. For example, after backfilling excavated areas disturbed to construct underground electrical cables, excess excavated soils would be spread around the surrounding areas and contoured to the natural grade. The areas affected by construction would then be seeded with an appropriate seed mix where there is adequate soil moisture, as appropriate to the location, and would be re-seeded if healthy cover vegetation does not grow. Similar restoration activities would be followed at areas temporarily disturbed for construction staging, equipment laydown, and temporary construction access. Onsite construction management would monitor the area for erosion and implement additional control measures if necessary.

Since project cleanup generally consists of landscaping and earthwork, it is weather- and season-sensitive. Landscaping cleanup is generally completed during the first allowable and suitable weather conditions after heavy construction activities have been completed. As described above, disturbed areas outside of the graveled areas would be reseeded to control erosion by water and wind. Construction cleanup and permanent erosion-control measures would be carried out in accordance with the project SWPPP. Other project cleanup activities might include interior finishing of the O&M facility, landscaping around the substation area, washing towers, painting scratches on towers and exposed bolts, and other miscellaneous tasks that are part of normal construction cleanup.

Construction Site Security

A full-time security plan would be implemented during project construction. A full-time bonded security officer would be on duty and would patrol the project site 24 hours per day, seven days per week. The officer would patrol the entire project site but would focus on those portions of the site that were under active construction. Site staff and subcontractors would be required to wear an identity badge and display vehicle clearance tags at all times. Newcomers to the project site would have to check in, log in, and log out at the main site’s construction trailers. The construction trailers would be equipped with outdoor lighting and motion-sensor lighting as required.

Construction materials would be stored at the individual turbine locations or at the laydown area around the perimeter of the O&M facility and site construction trailers. Temporary fencing with a locked gate would be installed for a roughly 1.5-acre area adjacent to the site trailers for the temporary storage of special equipment or materials. After construction is completed, the temporary fencing would be removed and the area reseeded with an appropriate seed mix.

The site project manager would work with a security contractor to develop a plan to effectively monitor the overall site during construction including drive-by surveys and specific checkpoints. The security inspection and monitoring plan would be changed throughout the course of construction based on the level of construction activity and amount of sensitive or vulnerable equipment and materials in specific areas.

Construction Schedule and Workforce

The Applicant anticipates that project construction would occur over a period of approximately one year from the time of site certification to commercial operation and would require the involvement of 253 personnel (Table 2-7). However, not all workers would be onsite at the same time. A peak workforce of up to 160 workers would be onsite during the busiest construction month when multiple disciplines of contractors complete work simultaneously (Table 2-8). It is estimated that local workers from Kittitas County would fill at least 40 of the projected 253 construction jobs.

Project construction would require approximately the same level of manpower and time regardless of whether the 330 or 410-foot turbine scenario is constructed. The larger turbines require a higher level of manpower and time for construction and erection since the foundations and roads are larger and preparation work for assembly requires more manpower. Regardless of the project configuration, it would require a total of approximately 253 staff to construct the project (Sagebrush Power Partners LLC 2003f). Some of the labor trades anticipated to be required during project construction include electricians, riggers, crane operators, blasting specialists, and heavy equipment operators (Taylor, pers. comm., 2003).

Table 2-7: Construction Labor Force Mix (Approximate Number of Personnel)

Construction Phase	Project Management and Engineers	Field Technical Staff	Skilled Labor and Equipment Operators	Unskilled Labor	Total
Engineering/surveying/design	6	12	0	0	18
Road construction	5	5	15	5	30
Foundation construction	3	4	23	30	60
Electrical collection system construction	2	3	23	12	40
Substation construction	5	3	8	4	20
Wind turbine assembly and erection	4	6	15	15	40
Commissioning and energizing the plant	5	10	15	0	30
Construction punchlist cleanup	1	1	3	10	15
Total	31	44	102	76	253

Source: Sagebrush Power Partners LLC 2003a, Section 2.12.3

Table 2-8: Construction Labor Resource Loading (Approximate Number of Personnel)

Number of Months Prior to Commercial Operation	Project Management and Engineers	Field Technical Staff	Skilled Labor and Equipment Operators	Unskilled Labor	Total
14	6	0	0	0	6
13	6	12	0	0	18
12	5	5	15	5	30
11	8	9	38	35	90
10	10	12	61	47	130
9	10	12	61	47	130
8	10	10	54	46	120
7	10	10	54	46	120
6	14	16	69	61	160
5	14	19	38	19	90
4	9	16	30	15	70
3	9	16	30	15	70
2	9	16	30	15	70
1	5	10	15	0	30
0	5	10	15	0	30
Cleanup	1	1	3	10	15

Source: Sagebrush Power Partners LLC 2003a, Section 2.12.3

2.2.5 Operation and Maintenance Activities

Routine Operation and Maintenance

The amount of downtime from scheduled maintenance is predictable from year to year. The proposed project's operating plan includes a planned outage schedule that consists of wind turbine inspections and maintenance after the first three months of operation, a break-in diagnostic inspection (includes inspection of oil and all other elements of the wind turbine generator) and subsequent services every six months. The six-month servicing generally takes a wind turbine off-line for one day. The six-month routine consists of inspecting and testing safety systems; inspecting wear and tear on components such as seals, bearings, and bushings; lubricating the mechanical systems; performing electronic diagnostics on the control systems; verifying pre-tension of the mechanical fasteners; and inspecting the overall structural components of the wind turbines. Blades would be inspected and, if heavily soiled, rinsed once per year to maintain overall aerodynamic efficiency. Blade washing is not anticipated as a requirement for the project since fall and spring rains would remove most if not all of the dirt.

Electrical equipment such as breakers, relays, and transformers requires weekly visual inspections, which does not affect overall availability, and testing or calibrations every one to three years, which may force outages. To the extent practical, the short-term off-line routine maintenance procedures would be coordinated with periods of little or no wind to minimize the impact on the amount of overall energy generation.

Unscheduled Maintenance - Forced Outages

Historically, modern wind power projects operate with an available range of 95% to 99%. Several components and systems of an individual wind turbine can be responsible for forced, non-routine outages such as the malfunction of mechanical and electrical components, or computer controls. It is anticipated that most of the outages would result from auxiliaries and controls, not malfunction or failure of the heavy rotating machinery. Most machinery failures are found during routine inspections, with the failing part being replaced before complete failure.

Although the newer control systems have added a high level of detection and diagnostic capability, they normally require frequent minor adjustments in the first few months of operation. As a result, available energy from wind power projects is generally lower in the first few months until the turbines are fully tuned. Once a wind plant is properly tuned, unplanned outages are rare and downtime is limited to the routine service schedule.

The O&M facility would be stocked with sufficient spare parts to support high levels of availability during operation. The modular design of modern wind turbines allows most of the parts to be quickly changed, especially in the electrical and control systems. This modularity and the fact that the turbines would be identical means components could be swapped between turbines to quickly determine causes of failures even if the correct spare part is not in stock. As part of their supply agreements, almost all major turbine equipment vendors guarantee the availability of spare parts for 20 years.

General project operations would require between 12 and 14 onsite staff consisting of a plant/site manager, operations manager, administration manager, administrative assistant, and operating technicians (Sagebrush Power Partners LLC 2003f). The number of on-site personnel is not only determined by the number of turbines, but also the type of turbine selected since some turbines require more man-hours of maintenance per year than others. It is estimated that approximately one-half of the full-time staff would be hired locally (i.e., from within Kittitas County).

Site Security

The plant operations group would prepare a detailed security plan to protect the project and project personnel. Site visitors including vendor equipment personnel, maintenance contractors, material suppliers, and all other third parties would require permission for access from authorized project staff at the O&M facility prior to entrance to secured project areas such as the turbines and substations. The plant operations manager, or designee, would grant access to critical areas of the site on an as-needed basis. Arrangements would be made with adjacent landowners that have legal ingress and egress easements across areas where project facilities would be located to ensure continued access to their property.

Currently, almost all existing field access driveways in the area are equipped with lockable gates. Similarly, access to the main O&M facility area, site trailers, and all wind turbine string roads would be constructed with lockable gates. The access gates would be open during working hours only while O&M staff are present on a particular access road and would be secured by project security personnel after working hours.

Both the O&M facility and the substations would be equipped with outdoor lighting and motion-sensor lighting. The PSE substation would be visible from the O&M facility. An 8-foot-tall chain-link fence would surround the substations with razor wire along the top. Wind turbines, pad transformers, pad-mounted switch panels, and other outdoor facilities would have secure, lockable doors.

An Emergency Response Plan would be established for the project to ensure employee safety for emergencies such as personnel injury, fires, explosions, and other scenarios where project evacuation would be required. The Emergency Response Plan would cover project employees, site visitors, and onsite contractors, and would be administered by the project operations manager or designee.

2.2.6 Decommissioning

The design life of major project equipment such as the turbines, transformers, substations, and supporting plant infrastructure is at least 20 years. The trend in the wind energy industry has been to repower older wind projects by upgrading older equipment with more efficient turbines. It is likely that after mechanical wear takes its toll, the project could be upgraded with more efficient equipment and could have a useful life longer than 20 years. Such upgrades may require additional EFSEC review and approval in advance of the repowering being performed.

If the project were terminated, the Applicant would request the necessary authorizations from EFSEC and landowners with which leases have been established to decommission the facilities. Foundations would be removed to a depth of 3 feet below grade and unsalvageable material would be disposed of at authorized sites. The soil surface would be restored as close as reasonably possible to its original condition. The Applicant proposes to provide a financial surety for funding decommissioning and site restoration activities (Sagebrush Power Partners LLC 2006). These funds would be made available to EFSEC once the project construction is substantially complete.

The project substation(s) is generally valuable and often times in older power projects, the substation would revert to the ownership of the utility (PSE or Bonneville). If the overhead power lines could not be used by the utility, all structures, conductors, and cables would be removed (Sagebrush Power Partners LLC 2003a, Section 7.3.2). The Applicant proposes to leave the underground electrical collection system in place subject to landowner approval. At the time of decommissioning, the Applicant would consult with the applicable landowner(s) to determine the appropriate disposition of the O&M facility (Taylor, pers. comm., 2003).

Reclamation procedures would be based on site-specific requirements and techniques commonly used at the time the area would be reclaimed and would include regrading, adding topsoil, and revegetating all disturbed areas. Decommissioned roads would be reclaimed or left in place based on landowner preferences, and rights-of-way and the leased property would be vacated and surrendered to the landowners.

2.3 CONSTRUCTION COSTS

The total project construction cost, including the equipment, construction, development, financing, legal, and study costs, is estimated to be $190,000,000 for a 65-turbine project (ECONorthwest 2006).

2.4 MITIGATION MEASURES INHERENT IN THE PROJECT DESIGN

In addition to complying with applicable codes and standards and implementing best management practices for erosion and sedimentation control, a number of measures have been included in the facility design to eliminate or minimize the project's impacts on the environment. These measures are presented throughout Chapter 3, Affected Environment, Impacts, and Mitigation Measures, for each resource topic. These measures have also been summarized in Table 1-3.

2.5 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

During the development phase of this project, the Applicant considered alternative wind turbine technologies to be used, alternative wind turbine locations, and an alternative project layout. The alternatives considered but rejected are described below.

Table 2-9: Comparison of Various Wind Turbines

Technology Type	Typical Generator Size	Typical Size	Approximate Number of Units Required for 181.5 MW	Typical Rotational Speed
(A) Darrieus rotor	50-100 kW	100-150 feet	2,400	50-70 RPM
(B) Two bladed (downwind)	50-200 kW	150-200 feet	2,400	60-90 RPM
(C) Three bladed (upwind)	500-750 kW	240-300 feet	290	28-30 RPM
(D) Three bladed (upwind) (Proposed Project)	1,300-2,500 kW (1.5-2.5 MW)	300-400 feet	121	10-23 RPM

Source: Sagebrush Power Partners LLC 2003b

2.5.1 Alternative Wind Energy Technologies

Several types of wind energy conversion technologies have been pursued over the past 30 years. Figure 2-6 and Table 2-9 compares various wind turbine technologies on the basis of the relative scale of commercially used wind turbine units and their typical sizes. For comparison purposes, Figure 2-6 also depicts, to scale, the existing Bonneville transmission lines in the project area. Although larger scale versions of these models have been produced, the diagram illustrates the average size of versions that have been implemented on a large scale with hundreds of units installed.

The proposed action contemplates the use of megawatt-class wind turbines, identified in Figure 2-6 and Table 2-9 as technology "D." Compared to the other three technologies illustrated, this type of turbine requires fewer machines, covers a smaller overall project footprint, and is anticipated to have fewer avian impacts because of a smaller Rotor Swept Area (RSA) and lower RPM. A discussion of other available wind energy technologies and the reasons for their rejection is presented below (Sagebrush Power Partners LLC 2003b). The choice of the three bladed, upwind, horizontal axis wind turbine (HAWT) technology meets the Applicant's need for: producing power cost effectively; maximizing equipment reliability; producing power at a commercially viable utility scale; maximizing power conversion efficiency; minimizing turbine footprint and associated ground disturbance, and minimizing avian impacts.

Vertical Axis Darrieus Wind Turbines (Technology "A")

French engineer D.G.M. Darrieus invented the most widely used vertical axis wind turbine (VAWT) in the 1920s. It is called the Darrieus wind turbine, Darrieus rotor, and is commonly referred to as the "eggbeater" (see Figure 2-6).

The Darrieus turbine was experimented with and used in a number of wind power projects in the 1970s and 1980s including projects in California; an experimental machine installed by FloWind on Thorp Prairie is located about 2 miles southwest of the Kittitas Valley Wind Power Project site. Despite years of design, experimentation, and application, the Darrieus turbine never reached full commercial-scale maturity and success to the level that the horizontal axis turbines have for a number of reasons including many inherent design and operation disadvantages, as discussed below (Sagebrush Power Partners LLC 2003b).

Higher Wind Speeds Higher Above the Ground

Darrieus rotors are designed with much of their swept area close to the ground compared to HAWTs. As the wind speed increases with the height above ground, HAWTs benefit from having higher wind speeds and higher wind energy incident to their rotor plane that can be extracted.

Start-up Wind Speed

VAWTs require a higher level of wind speed to actually start spinning compared to HAWTs. In older VAWT machines, the generator was used as a motor to start up the rotors. Modern VAWTs do not require generator to start up the rotor. HAWTs require less wind speed for start-up and most have the advantage of variable pitch blades, which allow the turbine to start up by a simple change to the blade pitch.

Variable Pitch

VAWTs do not have variable pitch capability and rely on stall regulation, which results in less efficient energy capture. Most modern HAWTs have mechanisms that pitch blades along their axis to change the blade angle to catch the wind. Variable pitch allows the turbine to maximize and control power output.

Bird Crash Hazards – Guy Wires

VAWTs are constructed with guy wires that add to the overall disturbed airspace area. Guy wires have been shown to be a greater hazard to birds than turbines themselves because they are difficult for birds to see. HAWTs are typically erected on free-standing tubular steel towers and do not require the use of guy wires.

Turbine Footprint

VAWTs are fitted with four sets of guy wires that span from the top of the central tower and are anchored in foundations. Including the tower base foundation, VAWTs require a total of five foundations all spread apart. The result is that the overall footprint and disturbed area for a VAWT is larger than that for a comparably sized HAWT. HAWTs on freestanding towers use only one main foundation and have a smaller overall footprint.

Fatigue Life Cycles

Because of their design, VAWTs have higher fatigue life cycles than HAWTs, resulting in earlier and more frequent mechanical failures. As the VAWT rotor blades rotate through one full revolution, they pass upwind, downwind, and through two neutral zones (directly upwind of the tower and directly downwind of the tower). In contrast, the rotor blades on a HAWT do not pass through similar upwind/downwind neutral zones, and their fatigue life cycles are lower.

Two-Bladed Downwind Wind Turbines (Technology “B”)

The most widely used vertical two-bladed wind turbines are of the downwind variety and are in the size range of 50 to 200 kW. They are referred to as downwind since the blades are downwind of the supporting tower structure. Although there is continued experimentation with prototype wind turbines of this design of a larger scale (300-500 kW), they are not as well proven as the three-bladed upwind technology. The two-bladed turbines require a higher rotational speed to reach optimal aerodynamic efficiency compared to a three-bladed turbine. Two-bladed turbines and the rotors also are more difficult to balance and this, combined with the downwind tower shadow, results in more mechanical failures compared to the three-bladed counterparts. As in the case of Darrieus turbines, two-bladed downwind turbines use guy wires, with higher associated avian impacts.

Smaller Three-Bladed Upwind Wind Turbines (Technology “C”)

Over the past 20 to 30 years, wind turbines have become larger and more efficient. For comparison purposes, a smaller 660-kW turbine is about 73% the height of a 1500 kW (1.5-MW), while its output is only 44% that of the 1.5-MW turbine. Compared to the proposed action, using smaller turbines in the 500 to 750 kW range would be less cost-effective and would require more than twice as many total turbines for an equivalent energy output. This would result in more turbine foundations, a larger project footprint, and an overall higher impact on the surrounding environment. Compared to the proposed project, use of such smaller turbines would also result in a greater total RSA to produce the same amount of energy, and therefore a greater incidence of avian impacts.

Figure 2-6

2.5.2 Alternative Wind Turbine Locations

Alternative Project Sites Considered by the Applicant

The siting of wind turbines is constrained by the need for a location with a sufficient wind resource to allow the project to operate in a commercially and technically viable manner. Therefore, wind turbines must be sited in locations where data show there are sufficient wind speeds on a regular basis throughout the year (Bonneville et al. 2002).

The Applicant’s proposal for the Kittitas Valley Wind Power Project identified and presented only the proposed project area for development. However, other alternative sites for the Applicant's proposal have been considered, as described in Section 2.6.

The study area was chosen primarily for its energetic wind resource suitable for producing electricity at competitive prices and access to several sets of power transmission lines that traverse the site and have adequate capacity to allow the wind-generated power to be integrated into the power grid. Other factors considered were site accessibility and surrounding land use compatibility. These combined factors rendered the proposed site the most practical and feasible from a technical and economic standpoint.

Other criteria used by the Applicant to determine if a possible site could jeopardize a project’s feasibility include lack of sufficient wind resource (leading to a price for the project's output that would be higher than the market price, thereby rendering the project economically infeasible) and/or remoteness from nearby transmission lines (which would require constructing a lengthy transmission line to interconnect with the power grid) (Bonneville et al. 2002). In Washington, the choice of potential project sites for producing wind-generated power is severely limited by the lack of sites with adequate wind resource potential to produce electricity at competitive prices. Compared with other states, Washington is ranked in the bottom tier in terms of wind energy potential (Pacific Northwest Laboratory 1991). Although there are other areas of the state predicted to have a wind resource adequate for producing energy at competitive prices, long-term ground-based measurements would be necessary to confirm the wind resource in these areas, and many of the areas would not be suitable for wind power development because of site inaccessibility (e.g., Cascade mountaintops) or incompatible land uses (e.g., the Yakima Training Center). Based on wind measurements collected in the mid-1990s and from late 2001 to the present, the proposed project site has a proven wind resource suitable for producing electricity at competitive prices.

Another factor in identifying a viable site for a wind power project is access to existing transmission lines with adequate outlet capacity. Wind power projects generally cannot absorb the capital cost of constructing tens of miles of new transmission lines to interconnect with the grid because of their generally smaller size and higher overall capital costs per MW of installed capacity. The project site is crisscrossed by six sets of high voltage transmission lines, several of which have adequate capacity and are of an appropriate voltage (230 to 287 kV) for a project of this size (97 to 195 MW).

To address the viability of other sites suitable for wind project development, Section 2.6 discusses other potential sites in Kittitas County and whether such sites meet baseline criteria for wind power development and are reasonably available to Sagebrush Power Partners LLC.

Alternative Project Layout

In siting the individual turbines within strings at the project site, the same factors that were used in choosing the study area were considered. The turbines have been sited to minimize environmental effects to the greatest extent possible while maintaining the commercial viability of the project. Mitigation is identified in this EIS to further reduce and avoid potential impacts.

An alternative layout of individual turbines and turbine strings in the project area (referred to as Alternative A) was evaluated during the early stages of project development and was subsequently refined to reduce potential impacts; the resulting layout defines the proposed action. The Applicant rejected Alternative A because of its higher environmental impacts. A summary of Alternative A is presented below (Sagebrush Power Partners LLC 2003b). The discussion below is limited to the "most likely" choice of turbine size.

Alternative A is composed of 174 wind turbine generators that would disrupt an approximate footprint of 105 acres (compared to approximately 93 acres for the proposed action) (Figure 2-7). Alternative A would extend several miles to the west of the proposed project area, across Swauk Creek to the western edge of Lookout Mountain. Alternative A would require constructing approximately 28 miles of new and upgraded access roads (2 miles more than under the proposed action) and about 5 miles of overhead electrical power lines (more than double the amount compared to the proposed action).

The larger permanent footprint covered by Alternative A would result in a greater magnitude of impacts on footprint-driven environmental resources, including land use conversion, area of visual disturbance, habitat loss, cultural resources disturbance, and construction truck trips. For example, Alternative A would generate 2,200 more construction truck trips than the proposed action. Alternative A also would result in potential interference to directional microwave telecommunication systems such as television and radio signals caused by eight turbines located on the edge of Lookout Mountain.

Compared to the proposed action, the additional turbines considered under Alternative A would likely result in additional wildlife impacts in terms of overall avian and bat mortality. Nine of the 174 turbines proposed under Alternative A would be located within three-quarters of a mile of the Yakima River. The proximity of turbines to the Yakima River could cause higher (per turbine) waterfowl and eagle mortality.

For example, compared to the proposed action, bird and bat mortality impacts would be greater by approximately 40%. A range of approximately zero to seven raptor fatalities per year could occur if 174 turbines were constructed, an increase of approximately two raptor fatalities per year over predictions under the proposed action. It is also estimated that approximately 70 to 430 birds may be killed annually, an increase of 20 to 130 passerine fatalities each year compared to the proposed action. It is further estimated that approximately 350 bats may be killed annually, an increase of approximately 110 bat fatalities each year compared to the proposed action.

Figure 2-7

Impacts such as bird and big game displacement would also increase as the number of turbines and roads increases. Furthermore, the impacts in the western portion of the study area near the nine turbines under Alternative A may be higher on a per turbine basis than most other areas of the wind plant because of the current low levels of human disturbance in that area. More elk and mule deer were observed in the western portion of the wildlife baseline study area, probably because of the lower levels of human disturbance.

2.6 CONSIDERATION OF OFFSITE ALTERNATIVES

Before the KVWPP Draft EIS was issued, EFSEC coordinated with Kittitas County regarding the evaluation of offsite alternative sites in the county. Four broad geographic areas were defined for investigation: west of US 97, east of US 97, Whiskey Dick Mountain, and south of the Whiskey Dick/Boylston mountains. The four areas were then compared against five key suitability criteria: (1) sufficient wind resource (the most important); (2) proximate/adequate transmission facilities; (3) large land area; (4) absence of significant environmental constraints; and (5) property owner interest.

After the Draft EIS was published, EFSEC re-examined the four sites considered in the KVWPP Draft EIS, namely Springwood Ranch, Swauk Valley Ranch, Manastash Ridge, and the Boylston Mountains, and two new sites, Skookumchuck Creek and Quilomene (Jones and Stokes 2004a). These sites were then evaluated against five criteria that are generally necessary for a site to be amenable for wind farm development. Two of the four sites, Swauk Valley Ranch and Springwood Ranch, were selected for further offsite alternative analysis, as were the Wild Horse Wind Power (Wild Horse) Project and the Desert Claim Wind Power (Desert Claim) Project. The analysis of these four sites was presented in a Draft Supplemental EIS issued in August 2004

The permitting and review status of the Wild Horse and Desert Claim projects has changed since issuance of the Draft Supplemental EIS. Governor Gregoire approved construction and operation of the Wild Horse Wind Power Project in July 2005. In October 2005 Puget Sound Energy (PSE) purchased the Wild Horse project from Horizon Wind. Project construction is expected to be substantially complete in late 2006, with commercial electricity sales beginning in December 2006.

Desert Claim Wind Power LLC submitted an application for the Desert Claim Wind Power Project in January 2003 to Kittitas County Community Development Services for permits to construct and operate the wind facility. Kittitas County issued the Desert Claim Final EIS in August 2004. The Kittitas County Board of County Commissioners denied Desert Claim's application in April 2005 (BOCC 2005). On November 7, 2006, Desert Claim LLC submitted an Application for Site Certification (ASC) to EFSEC (Desert Claim Wind Power LLC 2006).

As a result of the changes described above, the Wild Horse and Desert Claim alternative locations are not reasonably available to the Applicant. Consideration of these sites is therefore not included in this Final EIS. However, the Energy Facility Site Evaluation Council has considered the environmental impacts of the Wild Horse and Desert Claim projects (as presented in SEPA EIS documents) through other permitting actions (EFSEC 2004b, 2005a; Kittitas County 2004; Desert claim Wind Power Project LLC 2006).

2.6.1 Process for Identifying Offsite Alternatives

The method used to identify and evaluate offsite locations for the KVWPP was modeled after the approach used in the Desert Claim Wind Power Project Draft EIS developed by Kittitas County. The objective of the investigation was to identify wind resource sites within Kittitas County that could accommodate a wind power project in the megawatt size range and project footprint of the 330-foot turbine scenario for the KVWPP (i.e., 121 wind turbines and a permanent project footprint of 93 acres). The permanent project footprint for the 330-foot turbine scenario would include 21 miles of gravel access roads, 65 turbine tower foundations, underground and overhead electrical lines, grid interconnection substations, step-up substations, feeder lines from the onsite step-up substations to the interconnection substations, an operations and maintenance center, and supporting infrastructure.

In order to be considered as a potential offsite location, a site had to generally meet the following criteria:

- Minimum average wind speed of 16 mph. In the Pacific Northwest, the site for a potential wind power facility must have a minimum average wind speed of 16 mph to be considered economically viable. Potential sites are initially identified using wind energy maps, such as those published by the U.S. Department of Energy's National Renewable Energy Laboratory (NREL). Promising sites undergo intensive meteorological investigations, typically over a one- to two-year period. Once a site is selected, a computer model is used to identify the optimal location for each turbine;
- Existing 115-kV or 230-kV transmission line with unused capacity within 10 miles of site. Wind energy projects must connect to an electric transmission line to deliver power to the regional power grid. The costs associated with constructing a transmission line more than 10 miles to connect to the regional grid can make a site financially impractical;
- Large undivided parcels of land totaling a minimum of 6,000 acres. The amount of land required for a wind power project is directly related to the size of the project (in terms of power output) and the size and number of turbines. Large parcels in rural or agricultural settings with a dispersed population are preferred and tend to minimize the potential for land use conflicts;
- Kittitas County zoning classification of AG 20, Commercial AG, or Forest and Range. The zoning classifications of Agriculture (AG) 20, Commercial AG, and Forest and Range are associated with land uses that are generally compatible with wind farm development. The Kittitas County Zoning Code (Title 17) includes a Wind Farm Resource Overlay Zone that can be applied to any zone as long as the proposed site is appropriate, the welfare of the public can be protected, and the wind farm is compatible with nearby land uses;
- Absence of significant environmental constraints or conflicting land uses. Examples of significant onsite environmental constraints include lakes, rivers, and streams; wetlands; critical habitat; or recorded cultural or archaeological resources. Conflicting land uses include parks, recreation areas, and wildlife refuges. Sites with significant environmental constraints or conflicting land uses typically experience higher construction costs. Such sites are also subject to a complicated federal, state, and local permitting process that can be time-

> consuming and unpredictable. It is often best to entirely avoid sites burdened with substantial environmental constraints or conflicting land uses.

Consideration of alternatives has been limited to sites within Kittitas County based on EFSEC's requirement to consider alternative locations within the same county where the project has been proposed (WAC 463-28-040 [3]).

A variety of Geographic Information System (GIS) files for Kittitas County were obtained to assist with identifying potential wind power sites. Wind speed data were obtained from the NREL. NREL wind data for potential sites were reviewed and validated by a professional meteorologist with extensive knowledge of wind conditions in Kittitas County (Jones and Stokes 2004a).

Information on transmission line locations was obtained from Bonneville. GIS maps showing parcel boundaries, zoning designations, parks and recreation land, and wildlife refuges were obtained from Kittitas County. Information on wetlands was obtained from the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory and Kittitas County. Information on priority habitats was obtained from the Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species Database.

A total of six potential offsite locations were identified using the criteria and GIS maps described above. These sites are Springwood Ranch, Swauk Valley Ranch, Manastash Ridge, Boylston Mountains and two new sites—Skookumchuck Creek and Quilomene. Figure 2-8 shows the locations of these offsite alternatives in relation to one another.

2.6.2 Results of Site Screening Process

Table 2-10 summarizes how the offsite alternatives compare to each other relative to the five major screening criteria described in the previous section. A summary for each site is presented below. It should be noted that NREL wind maps for Kittitas County have been found to have an average error of +/-2.5 mph in most locations. In particular, the NREL maps tend to overestimate wind speeds at higher elevations (Nierenberg 2004).

Swauk Valley Ranch

The Swauk Valley Ranch site is located north of the Yakima River approximately 12 miles northwest of the City of Ellensburg near Lookout Mountain (Figure 2-9). Topography on the more than 6,000-acre site is gently rolling to steep. Typical elevations range from 1,640 to 3,280 feet above sea level.

The NREL wind maps show the quality of wind resources on the site falling primarily in the "Good 15.7 – 16.8 mph" range with a few upper elevation locations falling into the "Excellent 16.8 - 17.9 mph" and "Outstanding 17.9 – 19.7 mph" categories. However, wind data from other public domain and confidential sources suggest a more accurate rating for the site would be "Good 15.7 – 16.8 mph." A transmission line crosses through the center of the site in an east-west direction.

Several streams and small lakes are located on the site. Kittitas County wetlands maps identify nine wetlands on the site ranging from 0.25 acre to slightly more than 3 acres. The WDFW identifies approximately 220 acres of the northern portion of the site as western bluebird nesting habitat (a WDFW Monitor Species) and oak woodland as priority habitat. Several DNR-designated Natural Heritage Areas (thyme buckwheat/Sandberg's bluegrass, Ponderosa pine/common snowberry, and Oregon oak/Geyer's sedge plant communities) are located along the eastern edge of the site. The WDFW also indicates the entire site is mule deer/black-tailed deer habitat and the northern portion is elk habitat (WDFW 2004).

No recorded archaeological sites are located within the boundaries of Swauk Valley Ranch; however, eleven sites are within a 1-mile radius of the site. Most of the site is composed of large parcels (i.e., larger than 80 acres). Fifteen or so smaller parcels are located in the central portion of the site. Land cover on the southern half of the site is a mixture of grasslands and shrublands whereas the northern half of the site is dominated by conifer forest. The entire site is zoned Forest and Range. A large part of the site in the northern panhandle (over 3 square miles) is designated as a Nature Conservancy easement and is off limits to development.

Springwood Ranch

Springwood Ranch is an approximately 4,200-acre site located approximately 0.5 mile northwest of the town of Thorp and 10 miles northwest of Ellensburg. Springwood Ranch is bounded by I-90 (or Thorp Prairie Road) on the south and the Yakima River on the north (Figure 2-10). The western end of the property abuts the Sunlight Waters community in the Elk Heights area. The Iron Horse State Park/John Wayne Trail runs adjacent to or through the northern and eastern edges of the site. The northern boundary of the L. T. Murray Wildlife Recreation Area, which is managed by WDFW, is near the site but south of I-90.

The topography of most of the site is gently rolling, but steep bluffs and numerous canyons are located along the northern and eastern edges of the site. Typical elevations on the site range from 1,640 to 2,625 feet above sea level. Taneum Creek runs in a southwest-northeast direction through the eastern one-third of the site. The predominantly upland terrain on the site drops approximately 200 feet to the valley along Taneum Creek, causing a wind shadow over the eastern one-third of the property.

The quality of wind resources on the site fall primarily in the "Good 15.7 – 16.8 mph" category based on NREL wind speed maps. A Bonneville transmission line is located 1.5 miles north of the site across the Yakima River.

A tributary to the Yakima River (Taneum Creek) cuts across the southern half of the site in a southwest-northeast direction. Several smaller streams and irrigation canals are scattered across the site. National Wetland Inventory maps identify numerous (up to 20) wetlands on the site ranging from less than 3 acres to approximately 8 acres in size. Most wetlands are associated with irrigation channels or excavated ponds. The WDFW designates both the Yakima River and Taneum Creek as priority habitat for anadromous spawning and rearing. Riparian habitat along the entire length of Taneum Creek within the Springwood Ranch site is designated as priority habitat, as are portions of the Yakima River on the eastern boundary of the site (WDFW 2004).

Figure 2-8

Figure 2-9

Table 2-10 Summary of Initial Screen Findings

Screening Criteria	Swauk Valley Ranch	Springwood Ranch	Manastash Ridge	Boylston Mountains	Skookumchuck Creek	Quilomene
Minimum average wind speed of 16 mph	Good 15.7 – 16.8 mph	Good 15.7 – 16.8 mph	Good 15.7 – 16.8 mph	Good 15.7 – 16.8 mph	Good 15.7 – 16.8 mph	Good 15.7 – 16.8 mph
Existing transmission line within 10 miles of site	Existing line crosses through center of the site	Existing line located approx. 1.5 miles north of site across the Yakima River	Two existing lines are located within 3 miles of the site	Existing line approx. 2 to 3 miles east of site across the Columbia River	Closest line is approx. 6 miles east of site across the Columbia River	Closet line is approx. 8 miles east of site across the Columbia River
Large undivided parcels of land totaling approx. 6,000 acres	Most parcels are large, but some smaller parcels in central portion of site; total size >6,000 acres	Most parcels within site are moderate in size (~80 acres); total size ~4,200 acres	Most parcels are very large; total size >6,000 acres	Large parcels; total size >6000 acres	Large parcels; total size >6,000 acres	Checkerboard site with seven or more very large 1-square-mile parcels.; total size ~5,000 acres
Zoning: AG20, Commercial AG, or Forest and Range	Forest and Range	Primarily Forest and Range, some Commercial AG and AG 20	Commercial Forest	Commercial AG; site currently used for military training	Forest and Range	Commercial AG and Forest and Range
Absence of significant environmental constraints	Numerous small streams, small lakes, and scattered wetlands. Western bluebird nesting, several DNR-designated plant communities, designated mule deer and black-tailed deer habitat. No recorded archaeological sites. Northern portion of site is designated as Nature Conservancy easement.	Taneum Creek crosses the site and Yakima River borders eastern edge. Riparian habitat, anadromous fish habitat, scattered wetlands, steep slopes, and two recorded archaeological sites.	South Fork Manastash Creek crosses site and provides priority fish habitat, scattered small lakes, wetlands, and steep slopes. Site supports elk, mule/black-tailed deer, and bighorn sheep. Three recorded archaeological sites.	Numerous springs, small streams, and scattered wetlands. Site supports mule deer and chuckar partridge, nesting for Swainson's hawk, prairie falcon, and peregrine falcon, and four sensitive plant communities. Fifty-six recorded archaeological sites.	Situated between two wildlife areas. Skookumchuck Creek flows eastward through the center of the site. Site supports mule deer, elk, bighorn sheep, and two sensitive plant species. No known archaeological sites.	Two streams and three archaeological sites. Site supports shrub-steppe, mule deer, elk, and two sensitive plant species. Adjacent to Quilomene Wildlife Rec. Area and Ginkgo State Park and Petrified Forest.

Habitat on the site would support animals adapted to open grasslands or the ecotone between forest and grasslands. The Yakima River in this vicinity supports spring chinook salmon. Several species of trout, including bull and steelhead, have been reported. Lower Taneum Creek has been historically used by resident trout and anadromous fish for spawning and rearing. Taneum Creek is listed as a "water quality limited" surface water (for temperature and instream flow) under Section 303(d) of the federal Clean Water Act.

Two recorded archaeological sites are located within the boundaries of Springwood Ranch, and eight sites are located within a 1-mile radius of the site.

The surrounding area is primarily rural/agricultural (designated Forest Multiple Use and Agriculture in the Kittitas County Comprehensive Plan and zoned AG-20 and Forest and Range). A small cluster of commercial uses is located at Thorp (designated an Urban Growth Node in the Kittitas County Comprehensive Plan). Most of the site is zoned Forest and Range and a small portion of the site east of Taneum Creek is zoned Commercial Agriculture and AG-20. A ranch house and several accessory structures are located onsite. Most parcels within the boundaries of the site are moderate in size (i.e., larger than 80 acres). A few isolated residential and commercial land uses can be found around the perimeter of the site. Existing land cover includes substantial amounts of pastureland on the southern portion of the site and grasslands and shrublands on the northern portion of the site. A narrow band of conifer forest is located along the Yakima River along the site's northern boundary.

Manastash Ridge

The Manastash Ridge site is located south of I-90 and west of the Yakima River approximately 12 miles from the City of Ellensburg (Figure 2-11). The more than 6,000-acre site is situated between the L. T. Murray Wildlife Recreation Area and the Wenatchee National Forest. Site topography is generally steep with typical elevations ranging from 1,640 to 4,921 feet above sea level.

Wind resources are clustered in the northern and southern portions of the site ranging primarily from the "Good 15.7 – 16.8 mph" range to a few locations in the "Excellent 16.8 - 17.9 mph" and "Outstanding 17.9 – 19.7 mph" ranges based on NREL wind speed maps. Similar concerns over the positive bias of the NREL data for higher elevations suggest the "Excellent" and "Outstanding" ratings should be downgraded to "Good." Two transmission lines are located approximately 3 miles from the site—one to the north and one to the east.

South Fork Manastash Creek flows eastward through the center of the site. Numerous other streams and small lakes are located on the site. Kittitas County wetland maps identify four wetlands on the site ranging from less than 0.25 acre to 4.5 acres in size. The WDFW designates the South Fork Manastash Creek as priority fish habitat for its entire length within the site. The WDFW also indicates the eastern and southern portions of the site are cliff habitat and bighorn sheep priority habitat, and much of the site north of the South Fork Manastash Creek is elk and mule deer/black-tailed deer habitat (WDFW 2004).

Three recorded archaeological sites are located within the boundaries of Manastash Ridge, and twenty-one sites are located within a 1-mile radius of the site. Most of the site is made up of large parcels (i.e., larger than 160 acres). The land cover is a heterogeneous mixture of grasslands, shrublands, and conifer forest, and the entire site is zoned Commercial Forest.

Boylston Mountains

The Boylston Mountains site is located along an east-west trending ridge within the Yakima Training Center (Figure 2-12). Topography on the more than 6,000-acre site is generally steep with typical elevations ranging from 3,280 to 3,937 feet above sea level.

According to NREL wind speed maps, high quality wind resources ranging from “Excellent 16.8 - 17.9 mph” to “Superb >19.7 mph” span the entire length of the site. However, multi-year observations conducted by others suggest the site should more accurately be rated as “Good 15.7 – 16.8 mph.” The closest transmission line is located 2 to 3 miles east of the site across the Columbia River.

Numerous springs and small streams can be found on the site including a few scattered wetlands. Kittitas County wetland maps identify only one small wetland on the site just over 0.25 acre in size. The WDFW identifies nesting habitat for Swainson’s hawk, prairie falcon, and peregrine falcon in the west and central portions of the site and cliff habitat to the east. DNR-designated habitat for four sensitive plant species is located on the eastern portion of the site. The WDFW designates most of the south-facing drainages (approximately 7,000 acres) on the site as mule deer habitat and the eastern portion (3,400 acres) as chuckar partridge habitat.

Fifty-six recorded archaeological sites are located within the boundaries of the Boylston Mountains site, and twenty-three sites are located within a 1-mile radius of the site.

The entire site is located within the boundaries of the Yakima Training Center, a federal military reservation administered by the U.S. Department of Defense and actively used for military training. Existing land cover is primarily shrublands interspersed with small areas of grasslands. The entire site is zoned Commercial Agriculture.

Skookumchuck Creek

The Skookumchuck Creek site is located 6.5 miles north of I-90, west of the Columbia River (Figure 2-13). The more than 6,000-acre site is situated between the Quilomene Wildlife Area (on the north) and the Schaake Wildlife Area (on the south). Site topography is generally very hilly and steep with typical elevations ranging from 1,312 to 2,625 feet above sea level.

Wind resources across the site are considered “Good 15.7 – 16.8 mph” based on NREL wind speed maps. Onsite observations conducted by others confirm the rating for the site. The closest transmission line is approximately 6 miles east of the site across the Columbia River.Figure 2-9

Figure 2-10

Figure 2-11

Figure 2-12

Skookumchuck Creek flows eastward through the center of the site. Numerous other streams are located on the site. Kittitas County wetland maps do not show any wetlands on the site. The site is known to support white-tailed jackrabbit and two sensitive plant species. The WDFW has designated the entire site as mule deer, elk, and Rocky Mountain bighorn sheep habitat (WDFW 2004).

No known archaeological sites were identified within the boundaries of the Skookumchuck Creek site, although fifteen known sites are located within a 1-mile radius. The entire site is made up of 1-square-mile parcels and the existing land cover is mostly shrublands. The entire site is zoned Forest and Range.

Quilomene

The Quilomene site is located immediately north of I-90 approximately 4 miles northwest of the town of Vantage (Figure 2-14). The 5,000-acre site is made up of seven or more 1-square-mile parcels; some are contiguous but others are not. Each parcel making up the site abuts an adjacent 1-square-mile parcel that is part of the Quilomene Wildlife Recreation Area. The southernmost parcel abuts the Ginkgo State Park and Petrified Forest. Site topography is generally gently rolling with elevations ranging from 1,575 to 1,706 feet above sea level.

Wind resources for the site range from “Good 15.7 – 16.8 mph” to “Outstanding 17.9 - 19.7 mph” based on NREL wind speed maps. However, onsite observations conducted near the site by others suggest a more accurate rating for the site would be “Good 15.7 – 16.8 mph.” One transmission line is approximately 9 miles northwest of the site and another is located approximately 6 miles east of the site across the Columbia River.

Two small tributaries to the Columbia River flow eastward through the site. National Wetland Inventory maps do not show wetlands present on the site. Shrub-steppe habitat has been identified as priority habitat, as well as habitat for the night snake, elk, and mule deer (WDFW 2004). Two sensitive plant species have been recorded in the western portion of the site.

Three recorded archaeological sites are located within the boundaries of the Quilomene site, and seventeen sites are located within a 1-mile radius. Existing land cover is shrubland, and the site is zoned a combination of Commercial Agriculture and Forest and Range.

Offsite Alternatives Selection

All six sites were found to meet the minimum average wind criteria of 16 mph; however, none of the alternatives stood out as being superior to others based on wind data alone. Four of the sites (Springwood Ranch, Swauk Valley Ranch, Manastash Ridge, and Boylston Mountains) had existing transmission lines either on the site or within 3 miles of the site. Skookumchuck Creek and Quilomene were the farthest from existing lines at 6 and 8 miles, respectively.

All six sites are composed of fairly large parcels. Four sites (Swauk Valley Ranch, Manastash Ridge, Boylston Mountains, and Skookumchuck Creek) are well over the desired size threshold of 6,000 acres. At 5,000 and 4,200 acres, respectively, Quilomene and Springwood Ranch are below the desired size threshold.

Most of the sites have the required zoning classifications of AG-20, Commercial Agriculture, and Forest and Range. The exception is Manastash Ridge, which is zoned Commercial Forest, and is therefore not suitable for operation of a wind farm. The Boylston Mountains site is also unsuitable because it is actively used for military training purposes—a use that is incompatible with operation of a wind farm.

All of the sites have varying degrees of environmental constraints including onsite springs, streams, and wetlands. Springwood Ranch, Manastash Ridge, and Skookumchuck Creek all have large streams flowing across their sites, which can complicate site design, especially placement of access roads and other major facilities. The northern portion of the Swauk Valley Ranch site is off limits to development because it is protected by a Nature Conservancy easement.

All sites also have varying amounts of designated priority habitat for anadromous fish and large mammals, and known nest sites for raptors (WDFW 2004). The Springwood Ranch site has the most spawning and rearing habitat for anadromous fish, whereas the Manastash Ridge and Skookumchuck Creek sites support diverse large mammal populations (elk, mule deer, black-tailed deer, bighorn sheep). Sensitive shrub-steppe plant communities occur at Quilomene, and four sensitive plant communities are found at the eastern edge of the Swauk Valley Ranch site.

In addition, most sites have at least a few recorded archaeological sites within their boundaries. The Boylston Mountains site has the most at fifty-six recorded archaeological sites. The presence of archaeological sites can increase development costs by requiring expensive measures to avoid and possibly recover known or discovered cultural artifacts. Skookumchuck Creek and Quilomene are both immediately adjacent to wildlife areas that could be problematic for a wind farm operation. Quilomene also abuts Gingko State Park and Petrified Forest, both heavily used recreation areas.

Based on the screening criteria, only one site, Swauk Valley Ranch, stands out as a practical offsite alternative to the KVWPP. The Springwood Ranch site was also retained as a reasonable candidate for comparative offsite alternatives analysis, even though a wind resource project developed on this site would have lower economic viability.

In addition to the Swauk Valley Ranch and Springwood Ranch sites, the Wild Horse Wind Power Project and Desert Claim Wind Power Project, which have been formally proposed for wind power development, also meet the selection criteria for offsite alternatives listed above.

Figure 2-13

Figure 2-14

2.6.3 Reasonable Offsite Alternatives Brought Forward for Impact Analysis

Alternative 1: Swauk Valley Ranch

Although wind energy companies have investigated the prospects for wind energy development in the Swauk Valley Ranch area, there has been no specific proposal for a wind energy project on this site. The following project description is based on a conceptual layout prepared by Wind Ridge Power Partners LLC. The location of the site is presented in Figure 2-8, and the layout is shown in Figure 2-15. A conceptual layout of wind turbines and meteorological towers was prepared, but it does not include access roads, power collection cables, a substation, operations and maintenance facility, or a transmission interconnection. These facilities would be required for a wind power project at this site, and their characteristics would likely be similar to those defined in Section 2.2 for the KVWPP.

Location and Site Characteristics

The location and site characteristics of the Swauk Valley Ranch site are described in Section 2.6.2 above.

Wind Power Facilities

It is estimated that the Swauk Valley Ranch site could accommodate approximately 42 turbines, as shown in Figure 2-15. A smaller or larger number of turbines could potentially be accommodated through micro-siting. Using a 1.5-MW turbine, this number of turbines would generate approximately 63 MW of electric power, which is less than the capacity of the KVWPP under the 330-foot turbine scenario. This limited output raises questions whether this could be a commercially viable site; in any case, it is below the Applicant’s objectives for a wind power facility (i.e., at least 181 MW) and would not produce the amount of wind power currently being sought by regional utilities (e.g., in November 2003 PSE issued a request for proposals to acquire approximately 150 MW of capacity from wind power [PSE 2003b]). Because Bonneville electrical supply lines cross the middle portion of the site, connection to the power transmission grid could be readily accommodated.

Other project facilities and construction techniques would be the same as described for the proposed action. The project substation would be located on the property, whereas a switchyard would be located at the interconnection point. Project access roads would be similar in design to the proposed action and are estimated to be 10 miles in length. Based on corresponding unit factors for the various project components, the total area permanently occupied by project facilities in this case would be approximately 53 acres. The labor force required for construction and for long-term operation and maintenance of the 63-MW wind project on the Swauk Valley Ranch site would be smaller than for the proposed action, but the specific numbers or differences have not been estimated.

Figure 2-15

Alternative 2: Springwood Ranch

Although wind energy companies have investigated the prospects for wind energy development in the Springwood Ranch area, there has been no specific proposal for a wind energy project on this site. The following project description is based on a conceptual layout for a wind power project on the Springwood Ranch site, which was prepared by enXco, Inc. at Kittitas County's request specifically for use in the Desert Claim EIS. The location of the site is presented in Figure 2-8, and the site layout is shown in Figure 2-16. A conceptual layout of wind turbines and meteorological towers is presented in Figure 2-10 of the KVWPP Draft EIS, but it does not include access roads, power collection cables, a substation, operations and maintenance facility, or a transmission interconnection. These facilities would be required for a wind power project at this site, and their characteristics would likely be similar to those defined in Section 2.2 for the KVWPP.

Location and Site Characteristics

The location and site characteristics of the Springwood Ranch site are described in Section 2.6.2 above.

Wind Power Facilities

As described in Section 2.7.3 of the KVWPP Draft EIS, the Springwood Ranch site could accommodate 40 to 45 turbines. A smaller or larger number of turbines could potentially be accommodated through micro-siting. Using a 1.5-MW turbine, this number of turbines would generate approximately 64.5 MW of electric power, which is less than the capacity of the proposed action under the 330-foot turbine scenario. This limited output raises questions whether this could be a commercially viable site (PSE 2003b). Connection to transmission facilities (for the Bonneville lines) would require building a transmission line approximately 5 miles long and crossing the Yakima River. Easements would also need to be acquired to travel across private properties located between the project site and the transmission line.

Other project facilities and construction techniques would be the same as described for the proposed action. The project substation would be located on the property, whereas a switchyard would be located at the interconnection point. Project access roads would be similar in design to the proposed action but would be proportionally less in terms of total distance and disturbance. Based on corresponding unit factors for the various project components, the total area disturbed by construction activities for this alternative site would be approximately 110 acres. The total area permanently occupied by project facilities in this case would be approximately 30 acres. The labor force required for construction and for long-term operation and maintenance of a 65-MW wind project on the Springwood Ranch site would be smaller than for the proposed action, but the specific numbers or differences have not been estimated.

Figure 2-16

2.7 DESCRIPTION OF NO ACTION ALTERNATIVE

Under the No Action Alternative, the project would not be constructed or operated, and the environmental impacts described in this EIS would not occur. The No Action Alternative assumes that future development would comply with existing zoning requirements for the project area, which is zoned AG-20 and Forest and Range. According to the County's zoning code, the AG-20 zone is dominated by farming, ranching, and rural lifestyles, and permitted uses include residential and agriculture and forestry practices. Permitted uses in the Forest and Range zone include logging, mining, quarrying, and agricultural practices, as well as residential uses (Kittitas County 1991). Since the KVWPP ASC was submitted to EFSEC in 2003, such development has already been occurring in vicinity of the project area. Ellensburg Ranches Road has seen continued subdivision and development of larger recreational lots to smaller lots.

The Bettas Road area has also continued to be developed with a recent subdivision called Horse Canyon Estates consisting of 23 lots, and 10 structures already constructed (Garrett 2006).

If the proposed project is not constructed, it is likely that the region's need for power would be addressed by a combination of energy efficiency and conservation measures at the user's end, existing power generation sources, or by the development of new renewable and nonrenewable generation sources. Baseload demand would likely be filled be expanding existing or developing new thermal generation sources, such as gas-fired combustion turbine technology. Such development could occur at conducive locations throughout the state of Washington. Because constructing and operating a gas-fired combustion turbine is a predictable consequence of not building the project, it is considered a predictable outcome of the No Action Alternative (Bonneville et al. 2002).

Because the project would have a nameplate capacity of approximately 97 to 195 MW and is expected to have a 33% net capacity factor, a natural gas-fired combustion turbine would have to generate 32 to 64 average MW of energy to replace an equivalent amount of power generated by the project. (An average MW or "aMW" is the average amount of energy supplied over a specified period of time, in contrast to "MW," which indicates the maximum or peak output [capacity] that can be supplied for a short period.) Table 2-11 presents the basic parameters of a hypothetical 60 aMW natural gas-fired combustion turbine. The hypothetical combustion turbine could either be a new facility or an expansion of an existing facility.

Table 2-11: Potential Annual Requirements of Energy Generation for a 60-Average Megawatt Natural-Gas-Fired Combined-Cycle Combustion Turbine

Acreage Requirements	Onshore Gas Extraction	Transportation	Generation[1]
Permanent (acres)	NQ	NQ	14
Temporary (acres)	NQ	NQ	N/A
Employment			
Construction (employees/year)	1.74	27	130
Operations (employees per year)	0.18	0.78	9
Water Resources			
Consumption (acre-feet)	N/A	N/A	204
Discharge (acre-feet)	0.348 (drilling mud)	N/A	0.486

Table 2-11: Continued

Acreage Requirements	Onshore Gas Extraction	Transportation	Generation[1]
Air Pollutant Emissions[2]			
Sulfur oxides (tons)	57	0.024	1.8
Oxides of nitrogen (tons)	3.36	15.96	348.6
Particulate (tons)	0.078	N/A	1.8
Carbon dioxide (tons)	0	N/A	234,297
Carbon monoxide (tons)	0	N/A	133.8

Source: Bonneville and U.S. Department of Energy 1993

N/A = not applicable

NQ = not quantified

1 Acreage and employment estimates assume 65% capacity factor.

2 Emission estimates are based on 1993 data; correcting for technology improvements in emissions control, projected generation emissions of nitrogen dioxide and carbon monoxide are anticipated to be lower, but carbon dioxide emissions would be higher. See Section 3.11, Air Quality, for further discussion.

Impacts from gas-fired combustion turbine projects include air emissions and other impacts of construction and operation near the new plant, and impacts associated with natural gas extraction and transport. Combustion turbine projects require significant amounts of water, the extraction of which may have adverse impacts on surface water or groundwater resources. Gas extraction impacts include those related to drilling and associated development activities, and those related to ongoing operation of gas wells and associated delivery systems that would occur for the life of the project. Although it is speculative to estimate impacts of a similarly sized combustion turbine because of the uncertainty of the location and type of technology, impacts of a typical combustion turbine are identified in the No Action Alternative sections of Chapter 3 for informational purposes (Bonneville et al. 2002).

2.8 BENEFITS OR DISADVANTAGES OF RESERVING PROJECT APPROVAL FOR A LATER DATE

Several regional utilities have identified a need for renewable wind-generated energy to diversify their resource portfolios within defined periods of time. If project approval were delayed, these utilities may not be able to wait for the KVWPP to come on-line and may seek other energy sources. If the utilities are no longer interested in acquiring the KVWPP's output, this could make the project infeasible. Furthermore, failure to approve the project at this time would make it more difficult for these utilities to meet their stated goals of portfolio diversification at a minimum cost to their customers. Reserving project approval for a later date would delay all impacts of the project, including direct, indirect, and cumulative impacts.

Advantages of reserving project approval to a later date may include a better understanding of its economic and energy benefits versus cost in terms of environmental consequences or other issues.