Date:
U.S. Fish and Wildlife Service
Environmental Assessment for the Construction of Vertical Axis Wind Turbines – Alaska Peninsula & Izembek National Wildlife Refuges
King Salmon & Cold Bay, Alaska

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Abstract: The U.S. Fish and Wildlife Service Alaska Peninsula/Becharof and Izembek National Wildlife Refuges are proposing the installation of eight helical vertical axis wind turbines on refuge administrative lands. Funding for this project is available from the American Recovery and Reinvestment Act. The installation of these turbines will meet the objective put forth to reduce greenhouse gas emissions for federal buildings as well as reduce costs at the two refuges. The two alternatives considered in this document are: (A) to install helical vertical axis turbines at both refuges; and (B) to not install the turbines. The preferred alternative of the U.S. Fish and Wildlife Service is Alternative A.

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## 1.0 INTRODUCTION

The U.S Congress passed a bill to allow funding for federal projects under the American Recovery and Reinvestment Act. Through these available funds, the U.S. Fish and Wildlife Service (USFWS or Service) Alaska Peninsula/Becharof and Izembek National Wildlife Refuges (NWR) are proposing the installation of a total of eight, vertical-axis wind turbines (VAWTs) on refuge administrative lands. The funding of this project constitutes a federal action, therefore the Service is required to evaluate the potential environmental impacts in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ), Department of Interior (DOI) NEPA implementing regulations as well as USFWS NEPA policy. In compliance with NEPA (42 United States Code [U.S.C.] § 4321 et seq.) and the DOI NEPA implementing regulations (46 Code of Federal Regulations [CFR] Part 46) and procedures, this Environmental Assessment (EA) examines the potential environmental impacts of the Services' Proposed Action and No Action Alternative.

### 1.1 NATIONAL ENVIRONMENTAL POLICY ACT AND RELATED PROCEDURES

In accordance with the NEPA implementing regulations, the Service is required to evaluate the potential environmental impacts of Service facilities, operations, and related funding decisions. In compliance with these implementing regulations and procedures, this EA:

- Examines the potential environmental impacts of the proposed project, as well as a No Action Alternative;
- Identifies unavoidable adverse environmental effects of the Proposed Action;
- Describes the relationship between local short-term uses of the environment and the
- maintenance and enhancement of long-term productivity; and
- Characterizes any irreversible and irretrievable commitments of resources that would be involved should the proposed action be implemented.

These requirements must be met before a final decision is made to proceed with any proposed federal action that could cause adverse impacts to human health or the environment. This EA is intended to meet DOI regulatory requirements under NEPA and provide the Service with the information needed to make an informed decision associated with the installation of the proposed wind power generation system.

This EA evaluates the potential individual and cumulative effects of the Proposed Action. No other action alternatives are analyzed. For purposes of comparison, this EA also evaluates the impacts that would occur if Service did not support the installation of the wind power generation system (the No Action Alternative).

## 1.2 BACKGROUND

In January 2009, the Service applied for funding for this project through the American Recovery and Reinvestment Act. The bill was signed into law on February 17, 2009. The funding for the wind turbine project was approved on May 15, 2009. Both refuges currently use diesel fuel to heat the headquarters and living quarters. To offset the use of diesel and subsequent greenhouse gas emissions, the Service proposed the wind power project. The Service proposes to install a total of eight 5-10 kilowatt (kW), vertical-axis wind turbines (VAWTs) at both Alaska Peninsula/Becharof and Izembek NWR (Figure 1). The installation of these turbines is expected to reduce the amount of fuel used to provide heat for the refuges.

VAWTs are the preferred small-scale, renewable electrical power source over more conventional propeller-driven wind generators, based on comparable performance, 25-year reliable history of operation in cold climates, proven viability and favorable environmental and operational characteristics. The use of VAWT compared to horizontal-axis wind turbines (HAWTs) decreases impacts to wildlife, particularly birds and bats (Helix Wind http://www.helixwind.com/en/index.php)

VAWTs have an axis of rotation that is vertical to the ground and almost perpendicular to the wind stream. A significant advantage of VAWTs is convenience; the generator and gearbox can be installed at ground level, which makes these turbines easy to service and repair. In addition, unlike (HAWTs), which must face the wind to achieve maximum output and must be equipped with a yaw mechanism, VAWTs can use wind from any direction, making them suitable for areas with fast changes of wind direction. Depending on the design of the VAWT, these turbines can be propelled using **lift** or **drag** from the wind. Turbines operating via drag are considered to be somewhat less efficient than those that function via lift as they extract less of the wind's power than similarly sized lift-type turbines. As such, they are often used when reliability, durability, or aesthetics is more important than efficiency.

Wind power correlates directly with wind speed and swept-area. Although VAWTs don't necessarily produce more kilowatt hours (kW·h) than conventional wind generators, they can produce more kW·h per year than horizontal axis generators of equal swept-area because they harvest wind over a much broader spectrum of wind speeds (i.e., 6.44–193.12 kilometers per hour (KPH)) and can harvest wind from any direction.

## 1.3 PURPOSE AND NEED

Under the mandate of Executive Order 13423 (Strengthening Federal Environmental, Energy, and Transportation Management), the Service is required to "lead by example in advancing the nation's energy security and environmental performance" by achieving a number of goals, including increased purchases of renewable power sources and increased usage of renewable power. Executive Order 13514 (Federal Leadership in Environmental, Energy, and Economic Performance) builds on and expands the energy reduction and environmental requirements of Executive Order 13423 by making

"reductions of greenhouse gas emissions a priority of the Federal government and by requiring agencies to develop sustainability plans focused on cost-effective projects and programs". Federal agencies are required to set a 2020 greenhouse gas emissions reduction target. To meet these objectives, funding was received from the American

Figure 1. An Example of a Vertical Axis Wind Turbine.

Recover and Reinvestment Act to install a total of eight VAWTs at both Alaska Peninsula/Becharof and Izembek NWRs.

The Service is committed to a reduction in greenhouse gas emissions by implementing renewable energy sources, such as solar and wind generation, as appropriate. The Proposed Action would provide a cost effective and clean source of thermal energy for both refuges, reduce overall diesel fuel consumption, and decrease air emissions associated with the consumption of diesel fuel, thereby, reducing the greenhouse gas emissions from both refuges.

In addition to reducing greenhouse gas emissions, the turbines will reduce the fuel costs to the Service. Therefore, there are both environmental and economic objectives for this project.

## 1.4 PUBLIC SCOPING AND CONSULTATION

Federal, state, borough, tribal, and adjacent land owners were contacted regarding the Proposed Action and NEPA review process by letter, television/web reader board, and flyers (Appendix A). Alaska Peninsula/Becharof refuge held an Informational Open House on November 17 at the King Salmon Visitor Center. Staff at Alaska Peninsula/Becharof Refuge sent out 15 invitation letters to various parties throughout King Salmon and Naknek. In addition, the refuge enclosed an interested party postcard for individuals to indicate that they were interested in remaining on our mailing list to receive the EA when completed. Unfortunately, no one participated in the open house. However, the refuge did receive three interested party postcards as well as one written comment from the King Salmon Tribe stating that they did not have a problem with the installation of VAWTs on refuge lands or around King Salmon. Alaska Peninsula/Becharof Refuge followed up with the individuals by providing the fact sheet that was developed for the open house.

Izembek NWR held an Informational Open House on November 18 at the Cold Bay Community Center. Eight invitations were sent out to local constituents. Three people attended the open house and provided several comments that are addressed below.

The primary comments regarding the wind turbine project in Cold Bay were from the electrical utility, G&K, Inc. Cold Bay Electric. These comments included concerns regarding inter-connection and net-metering among others. Since the time of the meeting, the Service modified the scope of the project so that the proposed turbine project at both refuges will be providing thermal energy generation, offsetting fuel consumption rather than tying into the grid and offsetting electrical load. Therefore, the concerns of the electrical utility are no longer relevant to this proposed action and are therefore, not addressed in this EA.

In addition, the Service consulted with federal and state agencies regarding the potential environmental impacts associated with the Proposed Action. Specifically, the Service completed intra-section 7s for the Service's Endangered Species office; consulted with

the Service's Regional Historic Preservation Officer on cultural resources in the area of the placement of the turbines; and the Service will consult with both the Department of Defense (DOD), including the Department of the Air Force, and the Federal Aviation Administration (FAA). The Service finds the wind turbine project at both Alaska Peninsula/Becharof and Izembek NWRs to be fully consistent with policies of the Alaska Coastal Management Program. (Appendix B).

## 2.0 Alternatives

### 2.1 Proposed Action

The Service is proposing the installation of eight 5-10 kW VAWTs on administrative lands at Alaska Peninsula/Becharof and Izembek NWRs. Each turbine will be mounted on a free-standing, monopole unsupported by guy wires. At Alaska Peninsula/Becharof Refuge, one turbine will be placed at Refuge Headquarters (Figure 2) and one turbine will be placed at Quarters 1 and Quarters 2 (Figure 3), located in King Salmon, AK. These towers will be no more than 65 feet tall with a concrete base of 24' x 24'. At Izembek NWR, three to four turbines will be placed within the Refuge Headquarters area in Cold Bay, AK (Figure 4). These turbines will be no more than 25 feet high requiring a 24' x 24' concrete base. Transmission lines will be buried from the turbines to the respective buildings.

### 2.2 Project Location

**Alaska Peninsula/Becharof National Wildlife Refuge**

The administrative section of Alaska Peninsula/Becharof Refuge is located in King Salmon, Alaska, on the northern end of the Alaska Peninsula (Latitude 58.688330◦ N., Longitude -156.661390◦ W.; Sec.23, T017S, R045W, Seward Meridian) about 284 miles southwest of Anchorage (Figure 5). King Salmon is situated in the Nushagak-Bristol Bay lowland; a broad, low-relief piedmont characterized by arcuate belts of morainal topography and numerous small lakes and bogs (Wahrhaftig, 1965). The Naknek River is the principal drainage in the area.

The King Salmon area has a climate that is transitional between maritime and continental (Hartman and Johnson, 1984). The region is strongly influenced by cyclonic storms that originate in the Aleutians (Selkregg, 1976; Moritz, 1979) and the region experiences cool, cloudy, wet summers, and moderately cold winters (National Oceanic and Atmospheric Administration, 1980). Mean monthly summer temperatures range from 50.8 º to 54.3º F. Mean monthly temperatures in winter range from 15.5º to 17.3º F. Mean annual precipitation is 19.7 inches per year. Average annual snowfall is about 45.8 inches.

The moderate wind regime at King Salmon is characterized by southeasterly and easterly winter winds (October through March) that are associated with high pressure over northern Alaska and low pressure over the southern Bering Sea or Gulf of Alaska

(Keegan, 1958; Moritz, 1979). Summer winds (June through September) are primarily from the south and southeast, and usually result from a blocking ridge of high pressure that extends into Alaska from the southeast and cyclonic storm activity over interior Alaska (Reed and Kunkel, 1960; Streten, 1974; Moritz, 1979). Late winter and early spring winds (February through April) are primarily from the north and northeast. These spring winds also result from high pressure over northern Alaska and low pressure over the Gulf of Alaska (Moritz, 1979).

The turbine proposed for Refuge Headquarters is adjacent to state, residential and commercial areas, approximately 150-250 feet the Naknek River, and 2.1 miles west of the King Salmon airport. This location is accessible via a local service road that leads to refuge administrative buildings.

The turbine proposed for Quarters 1 and 2 are adjacent to largely undeveloped land. These turbines are approximately 1/3 mile from the Naknek River and are located at Mile 6 adjacent to the Alaska Peninsula Highway. The location is accessible via the driveway for both residences.

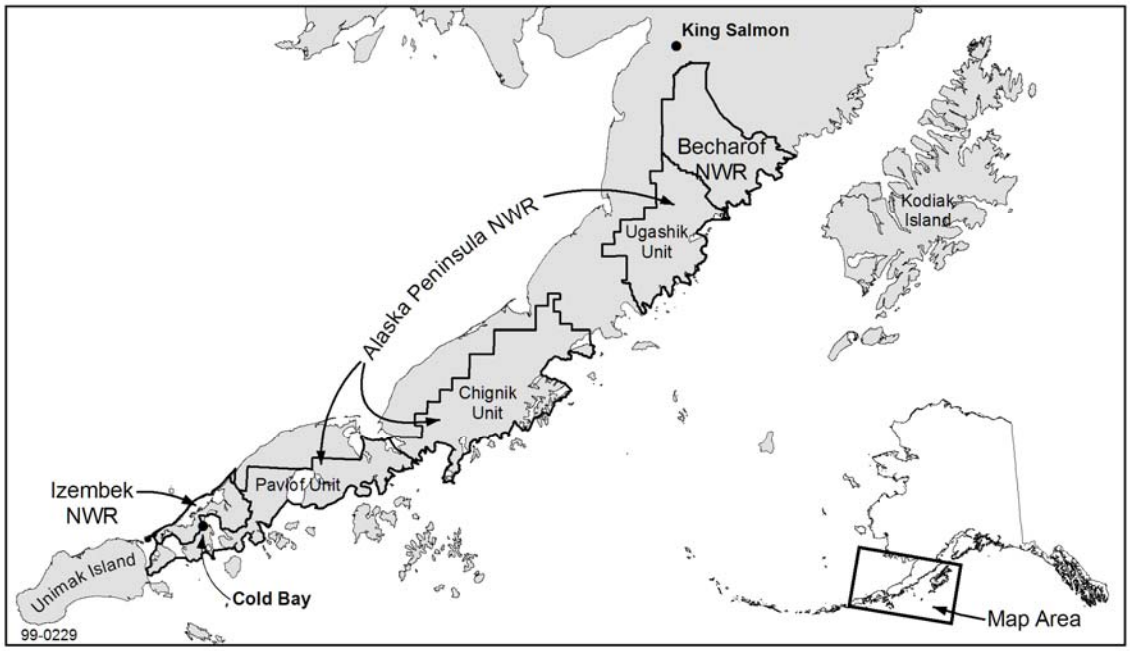
**Socioeconomic Description**

Approximately 442 people live in the greater King Salmon area (U.S. Census Bureau, 2000). The community has become an important regional center for government, transportation, and commercial fishing. The King Salmon Air Force Station is located in King Salmon and it shares a large runway with commercial and charter airlines. Over the past several years, the base has been downsized and is now operated by a small civilian staff. The Alaska Peninsula Highway connects King Salmon with the village of Naknek on the Kvichak Bay coast. The town of King Salmon consists of two and single-storied structures that serve as private residences, businesses, or support facilities for the Air Force and other Federal and State agencies. The Bristol Bay Borough is the local governmental entity.

**Izembek National Wildlife Refuge**

The administrative section of Izembek NWR is located in Cold Bay, Alaska (Latitude 55.185830◦ N. and Longitude -162.721110◦ W.; Sec. 25, T057S, R089W, Seward Meridian), at the western end of the Alaska Peninsula, approximately 634 miles southwest of Anchorage (Figure 5). Cold Bay lies in the maritime climate zone (Hartman and Johnson, 1984). Climatic conditions are influenced by the Bering Sea and the North Pacific and are characterized by small temperature variations, high humidity, heavy precipitation and frequent foggy periods. Cold Bay has one of the highest percentages of cloud cover in the United States. Cyclonic storms with high winds, low ceilings, and poor visibility occur frequently. Mountains rise more than 5, 906 feet, about nine miles south-southwest of Cold Bay. These mountains provide protection from approaching

Figure 5. Location of Alaska Peninsula/Becharof, King Salmon and Izembek NWR, Cold Bay, Refuge Headquarters.



southwesterly and southeasterly winds and precipitation. Mean monthly summer temperatures range from 45.5º to 55.7º F. Mean monthly temperatures in winter range from 29.1 to 36.6º F. Mean annual precipitation is 38 inches per year. Average annual snowfall is about 62 inches.

Cold Bay has topography similar to the nearby Aleutian Islands. The topography is characterized by rolling, treeless tundra that contain several lakes. The City of Cold Bay is on the south shore of Cold Bay, an embayment of the Pacific Ocean.

A total of three to four turbines are proposed for Izembek Refuge. These turbines will be located within the developed area of the Refuge headquarters complex (Figure 4). These turbines are adjacent to both residential and commercial structures and are approximately 0.15 miles from coastal waters. These turbines will be 0.5 miles northeast of the north-south runway of the Cold Bay airport. This location is accessible via a local service road that leads to the Refuge headquarters complex.

**Socioeconomic Description**

Approximately 88 people live in the greater Cold Bay area (U.S. Census Bureau, 2000). State and Federal government and airline support services provide the majority of local employment. Because of its central location and modern airport, Cold Bay serves as the regional center for air transportation on the Alaska Peninsula, and as an international hub for private aircraft. Cold Bay also provides services and fuel for the fishing industry and is part of the Aleutians East Borough.

## 2.3 Overview of Proposed Wind/Thermal Hybrid System

A low to medium penetration with coincident thermal wind energy generation is being proposed for both Alaska Peninsula/Becharof and Izembek refuges. This is due to both locations strong wind resource and the opportunity to optimize system economics through a major offset of heating fuel consumption and electric energy.

In the low to medium penetration design, it is anticipated total wind generating capacity may meet the facility peak power demand and heating fuel requirement. Through such a configuration, the wind turbines will provide a major heating fuel off-set by supplementing the thermal requirements, converting wind electric energy to thermal energy. Most hybrid systems, including the St. Paul Island wind energy system, use excess wind energy to create hot water based space heating further minimizing the dependence on heating fuel.

In the typical grid wind energy connection system, the electric utility must continue to supply energy regardless of wind speed and wind energy contribution. Here, the wind generator(s) runs in constant parallel with the utility, which serves to reduce the electric load at the facility, this configuration produces no cogenerated by-product such as hot water, as there is no excess energy. By integrating wind turbine generating capacity to achieve energy conservation as an aggregate of all energy, as well as the simultaneous production of a beneficial thermal, the conceptual design produces far greater total

energy avoidance in terms of fuel savings and superior long term total system operating efficiencies. Accordingly, this conceptual design focuses on the low to mid penetration model with thermal electric integrating thermal storage nodes as its first priority use for wind generated energy. Secondarily, excess wind generated energy will be used to off-set electric energy consumption.

The primary building blocks of the Service's hybrid wind system include the wind generation equipment, microprocessor based sensors that simultaneously monitor instantaneous load and wind speed, specialized controls that allow for seamless operation between the electric utility and, thermal electric nodes and hot water storage tank with associated thermal energy delivery infrastructure or as electric boiler system and energy storage. It is not intended to allow for a co-generated component (NET metering) with either electric utility in Cold Bay or King Salmon.

## 2.4 ELECTRIC THERMAL STORAGE

Integrated space/water heating systems combine the residential and headquarters heating requirement with the domestic hot water needs, saving money on total system installation. Typically, these systems employ an insulated external storage tank with a high-efficiency low-mass boiler to heat the water, which then passes through a fan coil or heat exchanger. The system then circulates the heat around the building through a warm air distribution system, like a conventional furnace or through hydronic base-board radiant heat.

For integrated systems that do not use high efficiency boilers, the initial cost saving is soon eliminated by very low seasonal efficiency. The heater is sized to produce enough heat to warm a house on the coldest winter day. However, in the summer months, when no heating is required, the same heater heats domestic hot water. The effect is an oversized water heater that operates for several months of the year with a low heating demand – and low efficiency, as a result.

The electrical thermal storage (ETS) central boiler consists of an on-demand heating equipment and a storage medium, called the thermal core node (TCN) and controls, which detect when it is necessary to accumulate a charge during turbine operation. Elements within the storage core heat ceramic bricks or similar media to a high temperature to provide the heating requirements for the on-peak period.

When the thermostat calls for heat, a pump circulates water or coolant through the thermal storage unit distributing the heated water to either a heat exchanger connected parallel with the existing boiler or across a liquid to an air exchanger for fan distribution heat throughout the room as a centrally-ducted ETS system for whole house heating.

All the performance levels related to the heating system rely on one key feature, the ability and efficiency of heat transfer. This applies when heat is transferred from the TCN into the heat transfer fluid (water). This also applies when heat is transferred from the convectors into the facilities.

## 2.5 PERMITS AND AUTHORIZATIONS

2.5.1 Air Safety Determination

Due to the proximity of the local airport, the FAA and the DOD will be contacted for comments and approvals.

2.5.2 Endangered Species

Both refuges completed an intra-section 7 with the Services Endangered Species office on the Steller's eider (*Polysticta stelleri)* and Spectacled eider (*Somateria fischeri*) (Appendix C).

2.5.**3** Compatibility Determination

The National Wildlife Refuge System Improvement Act of 1997 required that refuge managers determine whether proposed uses of refuge lands are compatible with the purposes for which the refuge was established and with the mission of the refuge system. The mission of the refuge system is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." Preserving the ecological integrity of refuge lands is a key component of the mission. Any use that might be expected to fragment or reduce the quality or quantity of habitat would not be compatible.

A compatible use is one that does not "materially interfere with or detract from" the ability of the refuge to carry out its purposes or fulfill the mission of the refuge system. The compatibility determination is a written determination, based on sound professional judgment, signed and dated by the Refuge Manager and Regional Chief. Consistent with the National Wildlife Refuge System Improvement Act, the Refuge Manager provides an opportunity for the public review and comment on the proposed action. The proposed VAWTS are to be placed in the administrative area of the refuges, within an office and housing developments. Therefore, a compatibility determination does not need to be completed.

## 3.0 AFFECTED ENVIRONMENT

This chapter describes the environment of the area to be affected by the Proposed Action and the No Action Alternative.

**3.1** Environmental Resources Analyzed but Not Discussed Further in this Environmental Assessment

### 3.1.1 Land Use

The turbines will be installed on administrative sites of both refuges. These lands have been previously disturbed with development of refuge office space and refuge living

quarters. Therefore, the Service has determined that an analysis of land use does not need to be explored.

### 3.1.2 Air quality

The proposed construction of the wind power system would result in a small quantity of exhaust emissions from construction equipment and fugitive dust from exposed soils during the short construction phase of the project. This temporary source of air emissions would not require any permits or affect the ability of the two refuges to meet all clean air standards. King Salmon and Cold Bay are currently in attainment for all EPA criteria pollutants (Alaska Department of Environmental Conservation [DEC], 2009). Fugitive dust would be minimized by watering the exposed bare solid surface of the construction site during periods of dry weather. The Proposed Action would decrease diesel fuel consumption, therefore, reducing emissions proportionally. Air quality was not identified as an issue during the scoping process.

### 3.1.3 Climate

The operation of the VAWTs would result in less greenhouse gas emissions due to the displacement of diesel fuel by renewable wind energy. Reduction of greenhouse gas emissions could potentially have a positive residual impact on the regional climate. However, the potential impact of an incremental change in emissions from one point source is likely to be negligible and cannot be estimated at this time.

### 3.1.4 Water resources (including wetlands)

There are no surface water sources such as streams or drainage channels that are located on the proposed project site or that could be affected by the construction and operation of the VAWTs. The proposed project would have no components that could alter or affect groundwater flows or quality.

The area where the VAWTs are to be placed is highly developed. No wetlands are in the vicinity of the VAWT sites. There would be no placement of fill in jurisdictional wetland on any of the VAWT sites.

### 3.1.5 Geology

King Salmon is situated in a lowland that is bounded by the northeastern Aleutian Range on the east, the southern Kuskokwim Mountains on the north, and the Ahklun Mountains on the west. Bedrock crops out mainly in the vicinity of Naknek Lake, where deep glacial erosion has stripped surficial deposits from the underlying bedrock. Scattered outcrops northwest of Naknek Lake and northeast of King Salmon consist of plugs, dikes, and lava flows of basaltic composition and subordinate lava flows and breccia of dacitic to andesitic composition (Church et al. 1989). At King Salmon, water wells drilled to 213 feet depth did not reach bedrock, and bedrock is not exposed in bluffs along the Naknek River at King Salmon (Muller, 1952).

Most of the landscape in the Cold Bay area was formed in the last 1 to 2 million years as a result of volcanism and glaciations (McLean, 1979). The distribution of volcanic rocks and surficial deposits are indicated on geologic maps of the area by Wilson et al. (1992).

Surficial deposits are of glacial, volcanic and coastal origin (Wilson et al. 1992). Moraines and other glacial deposits cover most of the lowland near Cold Bay. These deposits are exposed in nearby bluffs and consist of mixed sand and gravel. Rock fragments within the glacial deposits are mostly volcanic (Waldron, 1961). The thickness of glacial drift is unknown. Fine volcanic ash was deposited on exposed glacial deposits as evidenced by several layers of dark reddish-brown and black course-grained ash that are up to 5 inches thick (Waldron, 1961). Coastal deposits are composed of interlayered marine and alluvial deposits with grain sizes ranging from mud to boulders. No permafrost exists in the area of Cold Bay (Ferrians, 1965).

The installation of VAWTs would have no effect on the geology of the area and no issues were identified for geology during the scoping process.

### 3.1.6 Cultural resources

Debbie Corbett, the USWFS, Alaska Regional Historic Preservation Officer, reviewed both projects and as provided for in 36 CFR 800.3(a)(1) if a project has no potential to cause effects then the agency official has no further obligations under section 106 of the National Historic Preservation Act. Therefore, she has determined that the wind turbine projects have no potential to cause effects (Appendix D)

### 3.1.7 Coastal Zone Management

The Service finds the wind turbine project at both Alaska Peninsula/Becharof and Izembek NWRs to be fully consistent with policies of the Alaska Coastal Management Program.

### 3.1.8 Mammals

There are a number of terrestrial mammals that occur at both installation locations, including Arctic ground squirrel (*Spermophilus parryii*), red fox (*Vulpes vulpes*), moose (*Alces alces*), and brown bear (*Ursus arctos*), as well as other native populations of smaller species. However, habitat loss due to the project would be negligible for all mammal species based on the small area affected and abundance of similar habitat in the vicinity of Refuge headquarters and living quarters within King Salmon and Cold Bay. Wright (2008) reported a bear chewing through wires in False Pass during the installation of a wind tower. In response, the installers raised the data logger on the monopole to 25 feet to prevent repeat damage to the wires. Therefore, bear prevention measures will be required as King Salmon has high densities of brown bear. No further adverse effects for terrestrial mammals are likely from the construction and operation of the VAWTs.

In the contiguous United States, bat mortality has been documented in association with horizontal wind. Data indicate that danger to bat populations by horizontal axis wind turbines is caused by the drop in air pressure behind the large sweep of the rotor area due to blade tip vortices and the aerodynamics of propeller type airfoil rotors (Cryan and Barclay 2009). The VAWTs do not develop the same vortices or low pressure areas, as they do not utilize airfoils to develop rotation, but instead employ compressive moment at the front or concave surface of the rotor. Little is known about bats in southwestern Alaska. The little brown bat (*Myotis lucifugus*) is known to occur in King Salmon, but not in Cold Bay. No adverse effect to bats as a result of this VAWT project are anticipated.

The following sections describe the baseline (present) conditions in the area of the Proposed Action. These environmental resources, which have been selected for further analysis due to their relevance to the Proposed Action, are:

- Vegetation and soils
- Threatened and endangered species
- Birds
- Noise
- Visual environment or viewshed

### 3.1.9 VEGETATION AND SOILS

The majority of the vegetation found on and around the administrative areas of the Alaska Peninsula refuge is dwarf and low shrub, tall shrub, or mixed forest. The dwarf shrub is mainly composed of low and dwarf shrubs such as crowberry (*Empetrum nigrum*.), Labrador tea (*Ledum palustre*), kinnikinnick berry (*Arctostaphylos uvi-ursa*), willow (*Salix* spp.), and dwarf birch (*Betula nana*). Taller shrubs include alder (*Alnus viridis*), several species of willows (*Salix* spp.), and Kenai and paper birch (*Betula kenaica* or *B. papyrifera*). Species composition of mixed forest includes: white and black spruce (*Picea glauca* and *P. mariana*), birch, and cottonwood (*Populus balsamifera*). Sedges (Family Cyperaceae), forbs, mosses, lichens, and a variety of native and non-native grasses grow throughout the area and provide ground cover. Several non-native forbs inhabit the administrative area. The area is highly disturbed.

Vegetation around the administrative area of the Izembek Refuge is primarily dwarf to low shrub and forb meadow. The low shrub includes salmonberry (Rubus spectabilis) and the forbs are a rich assortment including orchids (*Piperia* spp.), monkshood (*Aconitum noveboracense*). and wild strawberry (*Fragaria vesca*). The area is highly disturbed. Except for a few Sitka spruce trees (*Picea sitchensis)*, the area is essentially treeless.

Surficial soils are classified as dystric cryandepts and are typically located on hilly to steep terrain (Reiger et al., 1979). These are well-drained, thixotrophic (becoming fluid when disturbed) ashy soils consisting of deep to moderately-deep volcanic ash over glacial till or cinders. A thin layer of organic material of decomposed alder leaves and grass typically covers the surface.

## 3.2 THREATENED AND ENDANGERED SPECIES

The Endangered Species Act (ESA) protects federally-listed threatened and endangered plant and animal species and their designated critical habitat. Endangered species are those that are in danger of extinction throughout all or a significant portion of their range. Threatened species are those that are likely to become endangered in the near future throughout all or a significant portion of their range.

The Steller's eider (*Polysticta stelleri*) (Alaska breeding population) is currently federally listed as threatened. Steller's eider are highly dependent on the health of lagoons and bays that promote the growth of eelgrass beds. Eelgrass communities are among the most diverse and productive in the world, providing food and nursery areas for fish, crabs, and many other invertebrates. The invertebrates, in turn, provide an essential food base for Steller's eider and other species (USFWS, 2003).

Steller's eider may use the Naknek River, adjacent to the installation of the VAWTs at Alaska Peninsula/Becharof NWR. Biologists from Alaska Peninsula/Becharof Refuge surveyed the Naknek River from 1991 to 2007 from mid-March to mid-May but did not document Steller's eider in the vicinity of the administrative area. However, a Steller's eider was found injured in 2003, possibly from striking a power line nearby (Appendix E). Birds are infrequently (less than once every three years) observed upstream or downstream of the administrative area in King Salmon.

Steller's eider regularly occur on Izembek NWR with Izembek and Nelson lagoons among the most important molting areas (USFWS 2003). These areas are designated critical habitat for the Steller's eider (66 FR 8849 8884). Refuge staff have reported a total of 44 Steller's eider striking various structures throughout Cold Bay from 1975 to 1983(Appendix F). In 1983, a total of 38 birds were found on December 30, killed by a radar screen at Grant Point. This installation was approximately 8 miles from the project area and was subsequently removed in 1998.

Spectacled eider (*Somateris fischeri*) nest in three primary areas, the coastal fringe of the Yukon-Koskukwim Delta, the Arctic Coastal Plain of Alaska and the eastern Arctic Coastal Plain of Russia. Important late summer and fall molting areas have been identified in eastern Norton Sound and Ledyard Bay in Alaska, and in Mechigmenskiy Bay and an area offshore between the Kolyma and Indigirka River deltas in Russia. Wintering flocks of spectacled eider, believed to represent the entire worldwide population, have been observed in the Bering Sea between St. Lawrence and St. Matthew islands (USFWS 2006).

Spectacled eiders have not been documented at Alaska Peninsula/Becharof Refuge administrative lands. However, a spectacled eider was sighted on the Naknek River at King Salmon in May, 1995. In addition, two spectacled eiders were found dead, one near the King Salmon control tower and one in the Naknek vicinity (1987 and 1988 respectively).

Spectacled eiders have only very rarely been documented near Izembek NWR administrative lands. A subadult male was observed off the Cold Bay dock (12/30/2005) and a pair was reported in the 1960's on Izembek Lagoon (Incidental Observation file at INWR). An adult male was observed in Herendeen Bay southeast of Nelson Lagoon on 4/7/1992.

## 3.3 OTHER BIRDS

Although no formal surveys have been completed for Alaska Peninsula/Becharof NWR headquarters or Quarters 1 and 2, several species of birds have been documented at refuge headquarters. Bald eagle (*Haliaeetus leucocephalus*) are commonly observed in the vicinity of refuge headquarters. They are protected under the Bald and Golden Eagle Protection Act of 1940. This act prohibits anyone, except under permit from the Secretary of the Interior, from "taking" bald eagles, their eggs, nests, or any other parts of the birds. The Act defines "take" as "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." In addition, black-billed magpie (*Pica hudsonia*) and common raven (*Corvus corax*) use the area. Tree swallow (*Tachycineta bicolor*) nesting boxes are in the vicinity of refuge headquarters. Several species of passerines nest in the area including: American robin (*Turdus migratorius*), golden-crowned sparrow (*Zonotrichia atricsapilla*) black-capped and boreal chickadee (*Poecile atricapilla* and *Poecile hudsonica*), and several species of warbler. Spotted sandpiper (*Actitus macularia*)and semipalmated plover (*Charadrius semipalmatus*) nests have been documented on or very near the headquarters area. Several species of ducks, such as the Eurasian widgeon (*Anas penelope*) use the immediate area of the river in front of the refuge (Appendix G). Merlin (*Falco columbarius*) have been documented to nest in a woodlot adjacent to the refuge headquarters. The same species of birds use the Quarters 1 and 2 area.

No formal surveys have been conducted for the administrative lands at Izembek NWR around the project site. However, bald eagle, black-billed magpie, common raven and other bird species use the area.

## 3.4 NOISE

The most common unit of measure used to describe the magnitude of sound levels is the decibel (dB). Sound levels are often stated in terms of decibels on the A-weighted scale (dBA), which is weighted to reflect the sound frequency range of human hearing. The dBA scale is used extensively in the United States (U.S.) to measure community and transportation sound levels, which decrease with distance from the source. Typical sound levels include about 110 dBA for construction noise, 90 dBA for a heavy truck accelerating, 60 dBA for a conversation, and 50 dBA for a quiet office.
Currently, no baseline noise data exists for King Salmon. However, the area surrounding the proposed locations for both refuges can be exceptionally noisy. Summer use of float planes on the Naknek River adjacent to refuge headquarters at Alaska Peninsula/Becharof Refuge and the year around use of airplanes at the King Salmon airport create loud,

intermittent noise. At Izembek refuge, the year around use of airplanes at Cold Bay airport can cause loud, intermittent noise.

## 3.5 VISUAL ENVIRONMENT

The proposed VAWTs would be located in an area already developed with buildings. At refuge headquarters at Alaska Peninsula/Becharof NWR, the VAWT is proposed to be 65 feet tall. This VAWT will be located adjacent to three communication towers, one of which is 67 feet tall. The turbine located at Quarters 1 and 2 will be the highest structure constructed due to the low vegetation found at that site.

At Izembek NWR headquarters, the VAWTs are proposed to be 25 feet tall. These VAWTs will not be as high as the existing four communication towers (50 feet tall) located adjacent to the headquarters building. Therefore, the VAWTs will not be the tallest structure in the headquarters complex.

## 4.0 ENVIRONMENTAL CONSEQUENCES

The Proposed Action would be constructed on previously disturbed site within the administrative boundary of both refuges. No adverse direct or indirect effects of the Proposed Action or of the No Action Alternatives on physical or human resources are anticipated. Short-term, construction-related impacts at the site would be mitigated by using best management practices and construction standards to minimize stormwater run-off, noise, fugitive dust, and other typical effects of construction. The operation of the VAWTs may have an effect on birds using the area. Therefore, the Service is implementing the Alaska Wind Guideline protocols to reduce these potential effects. The Proposed Action will benefit both Refuges by reducing their greenhouse gas emissions and may reduce their utility bills.

This chapter provides additional information related to the following resources and the probable impacts of each alternative on these resources:

**Table 4.1.** A comparison of the likely environmental impacts between the alternatives are summarized below.

| Issues | Alternative A (Install Turbines) | Alternative B (No Action) |
|---|---|---|
| Vegetation/Soils | 24' by 24' section of vegetation will be removed to provide the base for the turbines at each location | No impacts |
| Endangered and Threatened species | Steller's eider may use the adjacent wetlands, rivers, and bays associated with the turbine placement at Cold Bay. They may be affected by the turbine construction and operation. Spectacled eider are not documented in the vicinity of the VAWT placement at either refuge. | No impacts |
| Birds | Migratory and residential birds may be affected by the construction and operation of the turbines. | No impacts |
| Noise | Noise from heavy equipment operation and operation of the turbines | No impacts |
| Visual Environment | The turbines may disrupt the view shed | No impacts |

## 4.1 Vegetation and Soils

### 4.1.1 No Action Alternative

Under the No Action Alternative, the Service would not install the VAWT. Therefore, there would be no federal action. There would be no additional impacts to vegetation or soils at the proposed VAWT sites as a result of the No Action Alternative.

### 4.1.2 Proposed Action

Under the Proposed Action, vegetation will be cleared or disturbed by the construction and installation of the eight VAWTs. Much of the vegetation is non-native grass or forbs, or secondary growth from previous disturbance. Any native habitat that would be affected by this action is neither rare nor unique to the area and does not contain any critical habitat for any federally listed threatened or endangered species. The area affected by the VAWT foundations would be 24' by 24' for each VAWT.

## 4.2 Endangered and Threatened Species

### 4.2.1 No Action Alternative

Under the No Action Alternative, the Service would not install the VAWTs. Therefore, there would be no federal action and there would be no impacts to ESA-listed species or their critical habitat as a result of the No Action Alternative.

### 4.2.2 Proposed Action

Steller's and Spectacled eider are considered rare in King Salmon. However, Steller's eider have been documented molting and wintering in adjacent Bristol Bay and along the Pacific Coast of Alaska Peninsula and Becharof Refuge.

With the small number of Steller's and spectacled eider sighted in the King Salmon area, the ES office of the Service has determined that the project may affect but is not likely to adversely affect either species.

Steller's eider adults use Izembek and Nelson lagoons for molting. However, these lagoons are approximately 5.5 and 80 miles from the project site respectively. Steller's eider also use portions of Cold Bay during winter, some areas being less than 0.5 miles from the project site. However, these birds have never been documented flying over the project site area. Therefore, the Service has determined that the project may affect but is not likely to adversely affect either species or their critical habitat.

Both refuges consulted with the ES office. A term and condition in their respective intra-section 7 permit was to ensure that all transmissions lines from the turbines be underground. Both refuges will adhere to this term and condition.

## 4.3 Bird Impacts

### 4.3.1 No Action Alternative

Under the No Action Alternative, the Service would not install the VAWTs. Therefore, there would be no federal action and there would be additional impacts to birds as a result of the No Action Alternative.

### 4.3.2 Proposed Action

The VAWT installation at both Refuges may disturb birds and alter their use patterns in the immediate vicinity of the VAWT. The Service has determined that there will be little or no impact to existing bird use. However, both Refuges will be implementing post construction surveys and adhering to the Alaska Wind Turbine Guidelines.

The Bureau of Land Management (BLM) recently completed a Programmatic Environmental Impact Statement on wind power development in the western states,

excluding Alaska (BLM, 2005). No similar document has been prepared for Alaska. These data represent analysis of HAWT not VAWTs. However, the BLM document compared bird abundance and postconstruction mortality studies at numerous existing wind farms across the country and found that there was little correlation between species that are present in an area and those that are killed in collisions with wind turbines. The document concluded that not all species are prone to collisions at wind farms, probably through a combination of their typical flight patterns, their abilities to perceive the turbines, and their abilities to avoid the turbines. The BLM document notes that no bald eagles have been reported to be killed at any wind power farm in the western states. Corvids (ravens, crows, and magpies) are also apparently able to avoid collisions judging by their common frequency of occurrence versus their rare frequency of mortality. Erickson et al. (2001) also compared bird mortality rates at various wind developments and found a similar pattern: no bald eagles killed and relatively few ravens killed. According to manufactures of VAWT (Helix Wind; Tangarie Alternative Power), VAWT appear to be safe for wildlife because they spin at much lower speeds than horizontal turbines and appear as a solid mass rather than a sharp blurring blade that a bird or bat cannot see or detect. The compact design may also reduce harm to wildlife.

## 4.4 Noise

### 4.4.1 No Action Alternative

Under the No Action Alternative, the Service would not install the VAWTs. Therefore, there would be no federal action and there would be no additional noise impacts at the project site as a result of the No Action Alternative.

### 4.4.2 Proposed Action

During construction of the VAWTs, sound frequencies and levels would depend on the specific construction equipment used, the amount of equipment operating simultaneously, and hours of operation. It is anticipated that typical construction equipment would be used and that the hours of operation would occur only during normal working hours. In addition, it is anticipated that the construction activities would occur over a relatively short period.

When operating, HAWT produce a “swishing” or “whooshing” sound as their rotating blades encounter turbulence in the passing air, as well as some sounds from the mechanical parts such as the gearbox, generator, and cooling fans. At a distance of approximately 600 to 900 feet, the sounds generated by a wind turbine are frequently masked by the “background noise” of winds blowing through alders and brush or moving around obstacles. Wind turbines are typically quiet enough for people to hold a normal conversation while standing at the base of the tower. Helixwind conducted an assessment of noise from a VAWT. At low wind speeds (<7 m/s) it was difficult to measure any quantifiable difference in noise levels between the turbine running and stopped. Above 7m/s measurements varied between 0 and 4 dBA between operating and stopped. In both

cases, the ambient noise levels with the VAWT stopped varied by 5 to 10 dBA (www.helixwind.com).

There are three structures or areas where people are often or consistently gathered and that may be affected by chronic sound levels that would have potential impacts from the Proposed Action. At Alaska Peninsula/Becharof refuge, one location is the refuge office area. This area can be used by 25 refuge staff plus any persons staying at the duplex. The other VAWT is located adjacent to refuge quarters, where five people reside. At Izembek NWR, VAWTs are proposed for Refuge headquarters and living quarters. At any one time, five people could be around the VAWTs. VAWTs are documented between 0 and 4dBA and may be considered back ground noise due to the wind velocities at both refuges. However, whether or not this additional sound from the VAWT is considered an annoyance is subjective.

## 4.5 View Shed

### 4.5.1 No Action Alternative

Under the No Action Alternative, the Service would not install the VAWTs. Therefore, there would be no federal action and there would be no additional visual impacts to the project site as a result of the No Action Alternative.

### 4.5.2 Proposed Action

The VAWT at Alaska Peninsula/Becharof Refuge headquarters area would be visible. However, it would be shorter than the communication tower mounted adjacent to the area by the State of Alaska. As stated before, there are three existing communication towers adjacent to the refuge administrative lands. These towers range in height from approximately 60 feet to 67 feet. The addition of a VAWT at refuge headquarters would not be the tallest structure visible. The VAWT proposed for Quarters 1 and 2 would be visible from the Alaska Peninsula highway. They would be the tallest structures in the area.

At Izembek NWR, the VAWTs will not be the tallest structures. These VAWTs will not be as high as the existing four communication towers (50’ tall) located adjacent to the headquarters building. Therefore, the installation of the VAWTs will not disrupt the view shed in Cold Bay.

# 5.0 Mitigation Measures

## 5.1 Vegetation and Soils

A permanent loss of approximately 24 ft by 24 ft of vegetation will occur at each VAWT installation. The loss is due to the installation of the base of the VAWT. The remainder of the affected area would be maintained by mechanical cutting of brush to keep vegetation low in order to facilitate documentation of bird collision mortality. To reduce the impacts to the vegetation, all footings will be dug by hand and materials (soils/dirt)

removed for footing installations would be scattered outside the installation footprint. Cabling will need to be buried at each turbine location but this loss of vegetation will not be permanent. Vegetation would be cut by hand and folded back in sections for the length of the power corridor. The powerline would be laid on the humus layer and the vegetation mat restored to its original position. The vegetation mat should resume growing naturally within one summer.

### 5.2 Threatened and endangered species

Both Refuges have consulted with the Service's ES office. The Service has determined that the construction of the VAWTs may affect but is not likely to adversely affect either species or their critical habitat. However, the refuges must comply with the Alaska Wind Turbine Guidelines and conduct post-construction surveys around the VAWTs. These surveys would help reduce uncertainty regarding potential adverse effects to listed species. Both refuges would notify the ES office immediately if any ESA-listed species are found during the post-construction mortality surveys and would consult with them regarding the need for any additional measures. However, with the VAWTs, the Service is not expecting any take of listed species.

### 5.3 Other Bird Impacts

HAWTs are known to cause some degree of mortality to individual birds. The national average collision-related mortality for birds at wind farms is low (<3 birds/turbine/yr; Erickson et al., 2001). Collision mortality rate for birds based on rotor sweep area (RSA) for western and Midwestern wind farms is 1.1 to 5.6 birds/3,000 m2 and as measured by megawatt (MW) of the turbines, the collision mortality rate ranges from 0.9 to 4.7 birds/MW (Erickson, 2003). Data for VAWT has not been published; however the manufactures of VAWT cite the solid shape of the turbine as a deterrent for bird strikes (HelixWind, Tangerie).

Based on the location of these turbines, the low occurrence of birds in the general area and the low susceptibility to collision-related morality for the common birds that use the area (i.e. bald eagles, corvids and passerines - especially in the summer), avian collision mortality as a result of the Proposed Action is expected to be low and not adversely affect any local bird populations. With the VAWT, the Service is not expecting any impacts to birds.

The Service has published interim guidelines for wind power projects to minimize the potential risks of bird fatalities due to collisions (USFWS, 2009). Many of these guidelines pertain to siting considerations and are more pertinent to much larger projects. However, the following recommendations would be implemented:

1) Anti-perching devices would be placed on each VAWTs enclosed engine (if necessary) to discourage perching or nesting on the VAWTs, which would greatly increase the potential for bird collisions.

2) Anti-perching devices (if applicable) would be installed on electric poles in adjacent areas to discourage perching and reduce the potential for electrocution, especially for bald eagles. The VAWTs would not have external ladders or other structures that would allow birds to perch anywhere near the VAWT.

3) Structures with guy wires would be avoided. The VAWT would be self-supporting monopoles.

4) Any electric transmission lines from the VAWT to the electrical box would be buried below ground.

5) No lighting will be used on the VAWT towers (limited to what is necessary for aviation safety), unless otherwise determined by FAA.

6) A post-construction monitoring plan would be implemented for a minimum of two years, starting immediately after construction, to determine if birds are killed by collisions with the VAWT. The post-construction monitoring plan will be developed by Refuge staff biologists, but at the very least, they would sample for potential seasonal variations in bird collisions, with an emphasis on the fall and spring migration seasons when bird activity is expected to be highest. Searches would be conducted at a frequency that minimizes the potential for bias from scavengers that may include searching the VAWT locations on a daily basis during the spring and fall migration. The following elements would be incorporated into the post-construction monitoring plan:

a. Surveys would be conducted by trained observers who would record their name, date, time, and standard weather variables.

b. Each survey would include a search for dead or injured birds beneath each VAWT, conducted on foot by slowly walking transect lines. To date, survey methods for VAWT have not been developed. However, methods do exist for HAWT (California Energy Commission and California Department of Fish and Game [CEC/CDFG], 2007). Therefore, Refuge biologists will develop appropriate methods to survey VAWT based on existing methods.

c. If any bird is found, data would be collected on the following: its position relative to the VAWT; species (if possible); condition of the carcass; and evidence of scavenging. Refuge staff would establish a file for all search results, including records for searches when no birds were found.

## 6.0 Residual Impacts

### 6.1 Bird Collisions

The Service recognizes that there may be some bird collisions with VAWT even if all of their wind guidelines are followed (USFWS, 2009). Given the relatively low numbers of birds that have been observed to use the project area, the potential for future bird fatalities

as a result of the Proposed Action is considered to be very low. The actual level of collision related mortalities would be monitored by conducting a post-construction monitoring study at the VAWTs to determine the numbers and species of birds killed by collisions with the VAWTs. If post-construction monitoring indicates that bird collision rates are higher than expected or occur under particular conditions or seasons, additional measures would be taken by the Service to reduce residual effects. For instance, shut down the VAWTs if several birds are found dead in the immediate vicinity of the VAWT.

### 6.2 Noise

Manufactures of construction equipment are required to adhere to noise standards. These standards make it unlikely that excessive noise would be generated from the construction operations. All construction operations would occur during normal working hours. No other measures are recommended at this time.

Daily VAWT operation is expected to generate residual noise impacts. However, based on data collected by manufacturers of VAWT, the noise levels would be low to residents nearby the installed VAWTs and would be considered to have minor impact.

### 6.3 View Shed

The construction and operation of the Proposed Action would comply with all required regulatory statutes set forth by federal, state, and local regulatory agencies, including FAA Advisory circular 70/7460-1K. No additional measures or monitoring is recommended at this time.

The VAWTs would create residual visible impacts from numerous points in the both King Salmon and Cold Bay communities. However, this issue did not come up in public scoping. The residual visual impacts are therefore considered minimal.

## IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

An irreversible and irretrievable commitment of resources is defined as a permanent reduction or loss of a resource that, once lost, cannot be regained. The primary irretrievable and irreversible commitment of resources for the Proposed Action would be the labor, materials, and energy expended in clearing the site and constructing the eight VAWT. Other commitments include the loss of productivity of the sites (primary production and wildlife habitat) and the loss of an unknown number of birds due to collision with the VAWTs. These commitments of resources would extend for the duration of the project. The Service is considering a five year maintenance contract with the VAWT contractor to ensure performance of the VAWT.

## 7.0 UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts associated with the Proposed Action include:

1) Long-term loss of approximately 0.1 acres of vegetation resulting from the construction of VAWT foundations.

2) Increase in noise levels during construction of the foundations and erecting of the VAWTs.

3) Increase in noise levels to employees and residents working/living close to the VAWT sites.

4) Addition of eight vertical elements into the existing King Salmon and Cold Bay viewshed.

5) Potential direct impact to birds from collision with the VAWT. These impacts are both temporary, in the case of the construction noise, and long-term in regards to the visual impacts and impact to birds from potential collisions. Overall, impacts of the Proposed Action on the environment are considered negligible.

## 8.0 CUMULATIVE IMPACTS

Cumulative impacts result from the incremental impacts of an action that is added to other past, present, and reasonably foreseeable future actions (RFFAs), regardless of who is responsible for such actions. Cumulative impacts may result from individually minor, but collectively significant, actions occurring over a period of time (40 CFR 1508.7). The process of assessing cumulative effects therefore requires the agency to put the potential impacts of the proposed project into the context of the existing baseline conditions and projected impacts from other RFFAs. The baseline conditions for both King Salmon and Cold Bay and the potential impacts of the project are described in Chapters 1, 2, and 3 of this document. Past and present actions that have contributed to effects on birds have included the three towers that are co-located near refuge headquarters at Alaska Peninsula/Becharof NWR; the communication tower adjacent to Quarters 1 and 2; the powerlines adjacent to refuge headquarters and quarters 1 and 2; the existing four communication towers (50' tall) located adjacent to Refuge headquarters building at Cold Bay. The Service is unaware of any other RFFAs within the general project area that could contribute to any cumulative impacts.

The analysis of environmental consequences in Chapter 3 indicates that, relative to the existing baseline conditions, the proposed project would have minimal impacts on land use, coastal zone resources, vegetation and soils, threatened and endangered species, noise, and visual landscape. The Proposed Action would have negligible contribution to the overall cumulative effect. Past and present actions that have contributed to collision hazards for birds include the old communication towers and power lines. The Proposed Action would contribute to any cumulative effect on bird collision mortality; however, the overall cumulative effect would be nominal.

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