Appendix D

Biological Assessment

BIOLOGICAL ASSESSMENT FOR

NASA WALLOPS FLIGHT FACILITY

ALTERNATIVE ENERGY PROJECT

National Aeronautics and Space Administration

Goddard Space Flight Center

Wallops Flight Facility

Wallops Island, VA 23337

In cooperation with

U.S. Army Corps of Engineers, Norfolk District

March 2010

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1. Introduction

1.1 Purpose of Document

Section 7(c) of the Endangered Species Act (ESA) of 1973 requires that a Biological Assessment (BA) be prepared for all federal actions that may affect federally listed or proposed endangered or threatened species. The federal action considered in this BA is the construction, operation, and maintenance of two wind turbines in order to comply with Executive Order s(EOs) 13423, *Strengthening Federal Environmental, Energy, and Transportation Management* (effective January 24, 2007) and 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (effective October 8, 2009) and the Federal Energy Policy Act (EPACT, effective August 8, 2005). This BA encompasses a 25-year planning horizon, which is based on the expected life span of the proposed action.

The U.S. Army Corps of Engineers (USACE), Norfolk District is assisting NASA in preparing this BA. The USACE has permitting authority for the project under Section 404 of the Clean Water Act. In cooperation with USACE, NASA has prepared this BA to consider the potential impacts to listed species (under the jurisdiction of the U.S. Fish and Wildlife Service [USFWS]) that may occur within the proposed action area (see Figure 1, Proposed Action Area). Table 1 provides a list of species that may occur in Accomack County, Virginia, where Wallops Island is located. The species list was generated from the USFWS Federally Endangered, Threatened, Proposed, and Candidate Species List for Accomack County, VA.

Table 1: Federally Endangered, Threatened, Proposed Candidate Species in Accomack County

Scientific Name	Common Name	Status
Calidris canutus	Red Knot	Candidate Species
Charadrius melodus	Piping Plover	Threatened
Cicindela dorsalis dorsalis	Northeastern Beach Tiger Beetle	Threatened
Sciurus niger cinereus	Delmarva fox squirrel	Endangered
Caretta caretta	Loggerhead Sea Turtle	Threatened
Amaranthus pumilus	Seabeach Amaranth	Threatened

USFWS. 2008

No habitat exists for the Northeastern Beach Tiger Beetle in the action area. The Delmarva fox squirrel does not occur on Wallops Island. The Loggerhead Sea Turtle does not nest in marshes, and no construction would take place in the open water areas in which a marine turtle might be found. Seabeach amaranth is a beach plant species found on accreting sand shorelines and not in marshes. Therefore, these species are not considered in this BA.

The federally listed threatened or candidate species that may actually occur on and/or near the proposed wind turbine sites are listed in Table 2.

Table 2: Table 2: Potential Protected Species in the Action Area

Scientific Name	Common Name	Federal Status
Charadrius melodus	piping plover	Threatened
Calidris canutus	red knot	Candidate Species

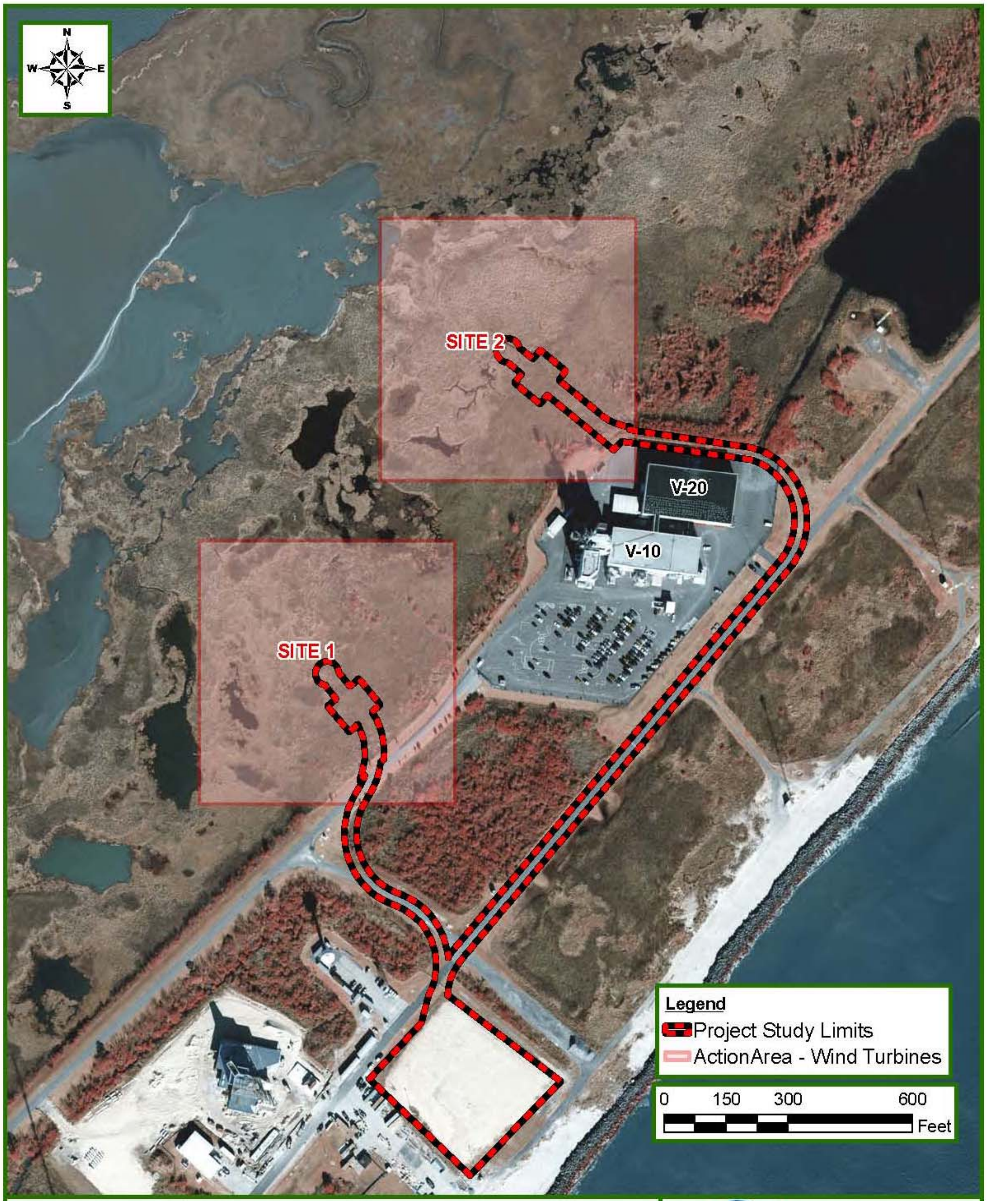

Figure 1: Proposed Action Area

2. Description of the Action

2.1 Proposed Action

NASA is proposing to construct two 2.0 megawatt (MW) wind turbines at the Wallops Flight Facility (WFF) located in Accomack County, Virginia that are capable of generating approximately 10 gigawatt hours per year (GWh/yr) of electricity. The wind turbines have an expected life span of 25 years. Because the proposed wind turbines have the potential to interfere with WFF's active airfields and tracking/telemetry systems, the area available for their construction is restricted to the proposed action area on Wallops Island, west of the U.S. Navy V-010/V-020 complex. The wind turbines would be constructed with a set-back distance of 153 meters (500 feet) from existing towers and buildings. The finished subsurface footprint of each wind turbine would be approximately 13 meters (42 feet) in diameter, with a 4.6 meter (15 foot) diameter surface foundation. A corridor 9.7 meters (32 feet) wide would be constructed for access roads to each wind turbine, including approximately 4.9 meters (16 feet) for a permanent gravel road surface and an additional 2.4 meters (8 feet) on each side for road shoulders. Power lines would be buried within or adjacent to the wind turbine access road corridors, as well as along existing roadways, before reaching an established point for interconnection with the existing Wallops Island 12.47 kilovolt electrical distribution system.

Previously disturbed areas, including the cleared area east of the U.S. Navy V-10/V-20 complex, would be used for staging of equipment and materials, and for construction vehicle parking. The construction period for two wind turbines would be approximately 6 months. A representative 2.0 MW wind turbine would have the following specifications:

- three composite (non-metal) rotor blades, each 42.5 meters (139.5 feet) in length;
- height of 120.5 meters (395.3 feet) at the top of the blade;
- a rotation speed of 9 to 19 revolutions per minute;
- a "swiveling" functionality so that rotor blades automatically rotate to face oncoming wind, and
- a generator and gearbox supported by elastomeric elements to minimize noise emission.

NASA would utilize data currently collected at various locations/towers on Wallops Island to monitor wind speed and direction, rather than build a new meteorological tower specifically for the proposed action. Operations and maintenance staff and equipment would be housed in existing NASA facilities, negating the need to construct any new buildings for operations and maintenance.

Routine service would be performed in accordance with the manufacturer's specifications in order to minimize wear and tear on the equipment, potential for excessive equipment breakdown and/or parts replacement and to maximize the energy production efficiency of the turbines. Unplanned maintenance would be carried out to any part of the wind turbines in response to a breakdown or failure.

2.2 Action Area

The Project would be located within the boundaries of WFF on Wallops Island in Accomack County, Virginia (see Figure 2, Vicinity Map). Wallops Island is a barrier island and is bordered by the Atlantic Ocean to the east. Wallops Island is located southwest of Chincoteague Island and east of Wallops Mainland, separated by Bogues Bay and numerous marshes, creeks, and tidal estuaries. The Project Area would be located in the Atlantic Ocean Coastal Watershed (HUC AO04). The site of the proposed wind turbine construction is located on Wallops Island within an intertidal, estuarine marsh approximately 304.8 meters (1,000 feet) southeast of tidal flats adjacent to Bogues Bay, and approximately 365.76 meters (1,200 feet) west of the Atlantic Ocean.

The area of effect for the construction of the turbines includes the footprint, access road infrastructure, work space for construction, and staging areas. The National Wetland Inventory (NWI) map identified multiple tidal and non-tidal wetlands throughout the site. There are four-distinct ecological communities including uplands, palustrine scrub-shrub wetlands, palustrine emergent wetlands, and estuarine intertidal emergent wetlands within the proposed construction footprint of the wind turbine facilities, access roads, and construction staging area. The construction of the proposed project would result in permanent impacts to 0.36 hectare (0.88 acre) of wetlands.

The operational area of effect of the wind turbines includes the overall height of the tower and top of the blades 120.5 meters (395 feet), the diameter of the blades 85 meters (279 feet), and the rotational area of the blades.

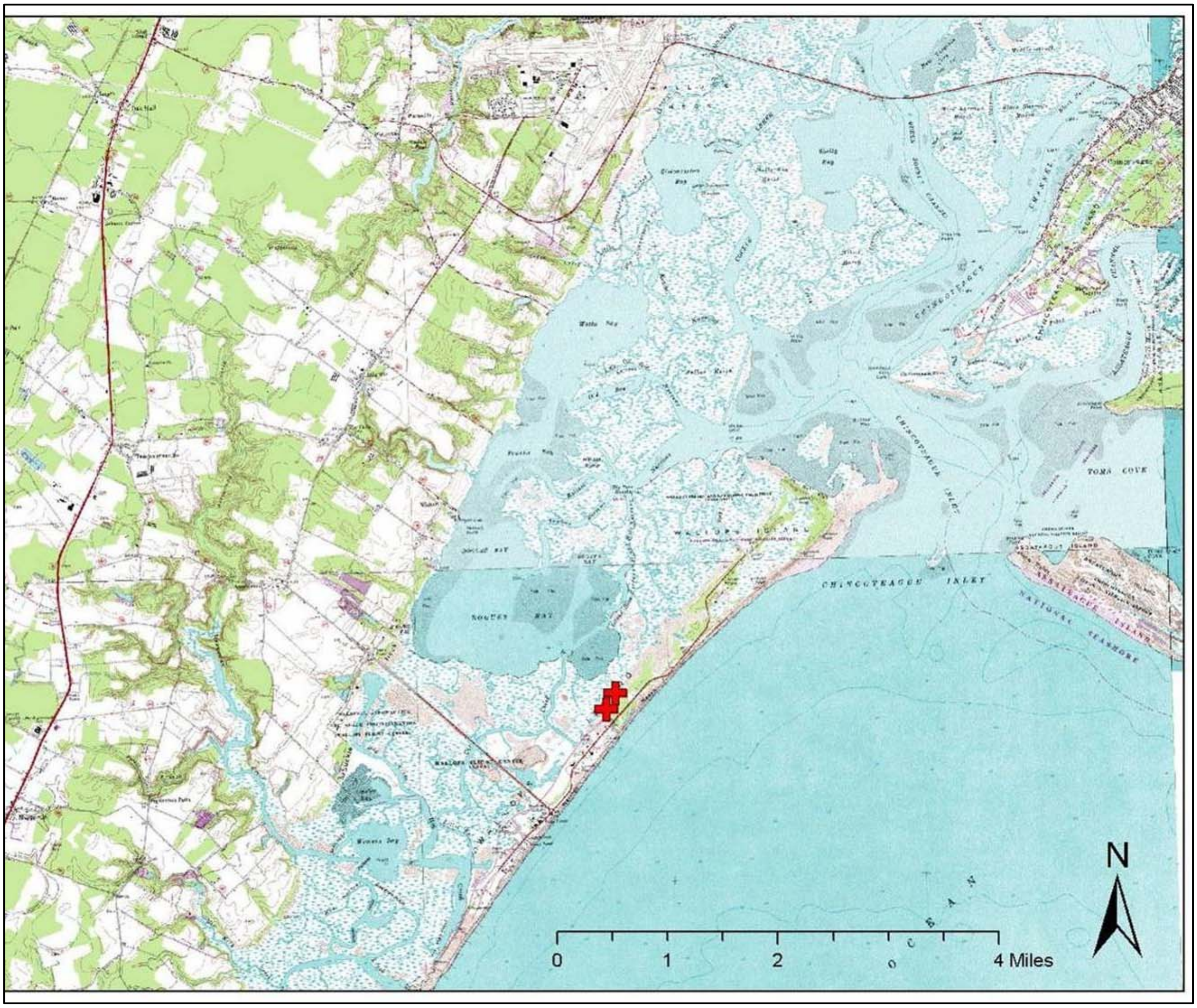

Figure 2: Proposed Wind Turbine Sites on Wallops Island

3. Species Potentially in the Action Area

3.1 Piping Plover

3.1.1. Description and Distribution

The Atlantic Coast piping plover population was listed as threatened on January 10, 1986.

Piping plovers are small, beige and white shorebirds with a black band across their breast and forehead. The plover breeds on coastal beaches from Newfoundland and southeastern Quebec to North Carolina to Florida, although some migrate to the Bahamas and West Indies. Plovers typically feed on invertebrates such as marine worms, fly larvae, beetles, crustaceans, and mollusks. Feeding areas include intertidal portions of ocean beaches, washover areas, mudflats, sandflats, wrack lines, and shorelines of coastal ponds, lagoons, or salt marshes (USFWS, 2006b).

3.1.2. Nesting

After they establish nesting territories and conduct courtship rituals which begin in late March or early April, piping plover pairs form shallow depressions (nests) in the sand to lay eggs. Nests are situated above the high tide line on coastal beaches, sandflats at the ends of sand spits and barrier islands, gently sloping foredunes, blowout areas behind primary dunes, and washover areas cut into or between dunes. Nest sites are shallow scraped depressions in substrates ranging from fine grained sand to mixtures of sand and pebbles, shells or cobble. They may also nest on areas where suitable dredge material has been deposited. Nests are usually found in areas with little or no vegetation although, on occasion, piping plovers will nest under strands of American beachgrass (*Ammophila breviligulata*) or other vegetation (USFWS, 2006b). Plovers typically lay four eggs that hatch in about 25 days (USFWS, 2007).

3.1.3. Status of Species in the Action Area

Since 1996, when monitoring was initiated at all Chincoteague National Wildlife Refuge (CNWR) units (including Assateague, Assawoman, and Metompkin) there had been an increasing trend in the number of nesting pairs (Table 3.1). However, since 2004, nesting has remained static and decreased at the Hook and Overwash areas, respectively, and has increased slightly at Assawoman and north Metompkin (Table 4).

Table 3: Table 3:. Record of Piping Plover Pairs and Number of Young Fledged at CNWR.

Year	# Pairs	# Young Fledged	Comments
1988[a]	32	27	0.84 young fledged/pair
1989[a]	32	36	1.13 young fledged/pair
1990[a]	42	24	0.57 young fledged/pair
1991[a]	38	30	0.79 young fledged/pair

Year	# Pairs	# Young Fledged	Comments
1992[a]	36	19	0.53 young fledged/pair
1993[b]	41	56	1.37 young fledged/pair
1994[b]	41	71	1.73 young fledged/pair
1995[b]	45	44	0.98 young fledged/pair
1996[c]	51	83	1.63 young fledged/pair
1997[c]	62	43	0.69 young fledged/pair
1998[c]	62	69	1.11 young fledged/pair
1999[c]	55	74	1.35 young fledged/pair
2000[c]	63	98	1.56 young fledged/pair
2001[c]	73	134	1.84 young fledged/pair
2002[c]	76	95	1.25 young fledged/pair
2003[c]	72	147	2.04 young fledged/pair
2004[c]	97	221	2.28 young fledged/pair
2005[c]	118	167	1.42 young fledged/pair
2006[c]	117	121	1.03 young fledged/pair
2007[c]	98	110	1.12 young fledged/pair
2008[c]	117	96	0.82 young fledged/pair
[a] Data from Assateague Island [b] Data from Assateague, Assawoman, and Metompkin Islands [c] Data from Assateague, Assawoman, Metompkin, and Cedar Islands			

USFWS, 2008

Table 4: Table 4. Piping Plover Nesting Activities at Each CNWR Unit.

Area	Year	Nesting Pairs	Nests Attempts	No. Eggs	Eggs Hatched	Chicks Fledged	Fledglings/ Nesting Pair
Hook	2004	27	30	105	90	70	2.59
	2005	32	39	143	91	58	1.81
	2006	27	30	102	72	37	1.37

Area	Year	Nesting Pairs	Nests Attempts	No. Eggs	Eggs Hatched	Chicks Fledged	Fledglings/ Nesting Pair
	2007	22	30	94	18	24	1.09
	2008	30	36	108	71	21	0.70
Overwash	2004	11	11	43	33	26	2.36
	2005	8	12	48	27	16	2.00
	2006	8	10	29	16	4	0.50
	2007	6	8	22	6	6	1.00
	2008	6	6	20	13	5	0.84
Assawoman	2004	23	23	92	87	61	2.65
	2005	30	37	123	62	34	1.14
	2006	23	25	84	64	28	1.22
	2007	23	25	88	68	40	1.74
	2008	26	35	114	74	30	1.15
North Metompkin	2004	4	4	7	7	7	1.75
	2005	3	6	21	5	3	1.00
	2006	6	7	22	10	9	1.50
	2007	6	6	21	13	10	1.67
	2008	7	8	N/A	N/A	8	1.14

Piping plover nesting habitat has been delineated on Wallops Island dune and overwash areas at the northern and southern reaches of the property. As south Wallops Island has experienced substantial erosion (3.3 m [11ft]/year), suitable habitat is increasingly less abundant. According to Mitchell (2009, pers. comm.), no nesting plovers have been observed on south Wallops Island since at least 2000. However, as is often the case in a dynamic beach environment, at any time, storm events may create new overwash areas. North Wallops Island has been accreting, thus presenting additional potential habitat for plover nesting.

Annually between 1996 and 2008, piping plovers were observed feeding on Wallops Island, although exact numbers were not recorded. Additionally, nests were observed on Wallops Island in 1996 (3 pairs with 2 chicks total fledged); 1998 (1 pair unsuccessful); 2001 (1 pair unsuccessful); 2004 (1 pair-3 chicks fledged); 2005 (2 pairs, lost to predation); and 2006, (1 pair, lost to predation by a fox). Five nesting attempts were made on north Wallops Island during 2007 and 2008 but none were successful in producing fledglings. There were no nests observed in 1997, 1999, 2000, 2002, or 2003 (Table 5).

In 2009, four piping plover pairs have attempted nests on north Wallops Island. Of these, three have been successful at producing ten fledglings (Scharle, 2009).

Table 5. Record of Piping Plover Pairs and Number of Young Fledged at WFF 1986 - 2008.

Year	# Pairs	# Young Fledged	Comments
1986	2	0	All at south end of Island
1987	2	3	1.5 young fledged/pair; All at south end

Year	# Pairs	# Young Fledged	Comments
1988	0	0	No nesting
1989	5	Unknown	All at south end
1990	5	Unknown	All at south end
1991	3	Unknown	All at south end
1992	4	5	1.25 young fledged/pair; All at south end
1993	3	4	1.33 young fledged/pair; All at south end
1994	3	2	0.67 young fledged/pair; All at south end
1995	2	4	2.00 young fledged/pair; All at south end of Island
1996	3	2	0.67 young fledge/pair; 1 pair, 0 fledged at south end
1997	0	0	No nesting
1998	1	0	
1999	0	0	No nesting
2000	0	0	No nesting
2001	1	0	
2002	0	0	No nesting
2003	1	0	A pair of plovers scraped, but made no other attempts at nesting
2004	1	3	3.00 young fledged/pair
2005	2	0	One nest was predated (fox), the other nest hatched by the chicks were later lost
2006	1	0	Nest was set up with enclosure; a fox tried digging under enclosure to get nest but did not succeed. The nest however was abandoned due to this event.
2007	3	0	All nests were exclosed. One nest was predated by a fox, one nest lost to tide
2008	2	0	2 pairs of plovers scraped at north end, but made no other attempts at nesting

NASA, 2008

3.2 Red Knot

3.2.1. Description and Distribution

The red knot is currently a candidate species for protection under the Endangered Species Act.

The red knot was once the most numerous shorebird in North America, but during the 1800s and early 1900s it was put under severe hunting pressure on its migratory route.

The Red Knot is a medium sized, bulky sandpiper. It is a relatively short bird, with short legs. The head and breast are reddish in breeding plumage and grey the rest of the year. Outside of breeding season, it is found primarily in intertidal, marine habitats, especially near coastal inlets, estuaries, and bays. The Red Knot breeds in drier tundra areas, such as sparsely vegetated hillsides. The Red Knot typically feeds on invertebrates, especially bivalves, small snails, and crustaceans. During breeding season, the Red Knot also eats terrestrial invertebrates (Harrington, 2001). The Delaware Bay stopover is the final and most crucial spring stopover during the northern migration. This is because the birds feed on the eggs of spawning horseshoe crabs in preparation for their nonstop leg to the Arctic. The birds rest and feed in the Delaware Bay between late April and early June with the population peaking May 15th through 30th (Baker et al., 2004).

3.2.2. Nesting

The red knot nesting areas are located in the high arctic.Barrier islands merely provide a stopover point along their migratory route. No nesting activities are expected in or around the proposed action area.

3.2.3. Status of the Species in the Action Area

Recent research (Cohen, et. al., 2009) indicates that a significant portion of the red knot population utilizes the Virginia barrier islands as a stopover point on the migration north. Instead of horseshoe crab eggs, these birds feed on blue mussels, coquina clams, and various species of amphipods (Truitt and Brown, 2001). In the mid-1990s, 3 years of aerial surveys showed that numbers of red knots moving through the barrier islands of Virginia between mid-May and the second week of June reach 8,000 to 10,000 individuals (Watts and Truitt, 2000). During the 2009 migration season, flock sizes of 100 to 145 birds were observed in the Overwash and Hook areas of Assateague Island. In late May 2009, flocks of 5 to 30 individuals were observed on south Assawoman Island. On May 8, USFWS observed a flock size of almost 1,300 individuals on north Wallops Island (USFWS, 2009c). In late May 2009, flocks of approximately 20 to 200 red knots were observed on north Wallops Island (USFWS, 2009c).

4. Effects of the Proposed Action

Potential avian impacts associated with construction and operation of the proposed action could include loss of habitat; disturbances associated with the presence or activity of construction equipment; disturbances such as barriers to flight paths due to the presence of the turbines and the risk of collision with wind turbine blades.

4.1. Piping Plover

4.1.1. Direct and Indirect Effects

Both the northern and southern delineated piping plover nesting areas on Wallops Island are located a minimum of 4.8 km (3 miles) from the proposed action area. Additionally, the action area is located in wetlands on the western side of Wallops Island while the plover habitats are found on the beaches of the eastern side of Wallops Island.

Under the proposed action, no construction is planned for areas within known piping plover nesting habitat. Noise from construction activities would be of short duration and would likely present minor startle reactions. Temporary interruption of foraging and nesting activities for piping plover may occur as a result of human presence during staging and construction activities but the effect is unlikely.

The potential exists for piping plover to collide with the wind turbines, including the blades and tubular towers during breeding, staging, and migration periods. The results of available terrestrial mortality studies conducted primarily terrestrial environments for general avian species indicate that the majority of collisions with man-made structures take place at night during periods of inclement weather (Kerlinger, 2000). Birds that fly within the rotor zone of the proposed turbines during periods of low visibility would be at the greatest risk of collision. It may be that plovers wait out inclement weather conditions prior to flight. Peterson et al. (2006) observed a substantial decrease in the volume of migrating birds at an offshore facility in Europe during periods of low visibility and elevated collision risk.

Height of flight is an important factor to consider when assessing the risk of collision to piping plover. During the breeding season piping plover are mainly sedentary as they forage on invertebrates in the inter-tidal beach zone near nest sites. During this period, plovers mainly travel by walking or running between proximal foraging and breeding sites, however, some plovers may undertake short flights to foraging areas, flying low over the water (or adjacent land), typically less than 10 meters (33 feet), but sometimes at higher, unknown altitudes (Cape Wind Associates, 2007a). Their regular daily movements are not expected to result in crossings of the proposed action area. Unusual crossings of Wallops Island during the breeding season could include the crossings of failed breeders or unpaired birds seeking alternate habitat or a mate. However, a study conducted on Cape Cod in Massachusetts indicated that most breeding plovers did not change mates or move to new territories between nesting attempts (MacIvor, 1990). Due to the relatively sedentary behavior of piping plover during breeding season, the wind turbines are not anticipated to create a major barrier to the flight paths of piping plover during the breeding season. Therefore, given that historical nesting sites have been on the opposite side of the island to the action area, effects from the proposed action would likely be insignificant to breeding plovers.

The majority of Atlantic Coast piping plover migratory movements are presumed to take place along the outer beaches of the coastline (USFWS, 1996), both during the day and night (O'Brien, et al., 2006). Most movements are presumed to occur along a narrow flight corridor, and offshore and inland observations are rare (USFWS, 1996). There is a great deal of uncertainty surrounding the migratory flight paths of piping plover. The hypothesized movement of piping plover along the shoreline during migration is based on observations of birds at stop-over locations along the Atlantic Coast, however the paths actually taken between these stop-overs are not documented. Some birds may occur inland or offshore while migrating if blown off course by weather events, although sightings away from the outer beaches, either inland or offshore, are rare (USFWS, 1996). The number of annual piping plover crossings of Wallops Island is unknown. However, since the best available information suggests that migration movements are believed to largely occur along the outer beaches, it is expected that the presence of the wind turbines would not present a major barrier to the flight path of migratory birds.

The risk of collision of piping plover during migration movements would be based on flight frequency through the proposed action area, height of flight, visibility conditions, and turbine avoidance behaviors (which are not known). Cape Wind Associates (2007b) used the Band model to estimate a 91 to 99 percent plover avoidance rate based on a range of known avoidance rates calculated for other species. These avoidance rates are consistent with rates calculated at a few existing wind farms in the U.S. where mainly geese and raptor species were estimated to have avoidance rates greater than 95 percent. Fernley et al. (2006) calculated the avoidance rates of geese at four land-based wind farms in the U.S. using the Band Collision Risk Model. The avoidance rates calculated at the four facilities ranged from 99.82 percent to 100 percent despite high use by geese at these wind farm sites.

4.1.2. Actions to Reduce Adverse Effects

Under the Proposed Action, the wind turbines and access roads would be constructed on the opposite side of the island from the piping plover preferred habitat and historical nesting sites. No construction is planned for areas within known piping plover nesting habitat. Noise from construction activities would be of short duration and would likely present minor startle reactions. Temporary interruption of foraging and nesting activities for piping plover may occur as a result of human presence during staging and construction activities, however any such effect is unlikely as these areas are approximately 4.8 km (3 miles) from the action area. Therefore no attempt would be made to reduce adverse effects to piping plovers from construction activities.

The Federal Aviation Administration (FAA) requires that any structure taller than 61 meters (200 feet) above ground level must have aircraft warning lights. Gehring, et. al. (2009) found that the use of red or white flashing obstruction lights strongly correlated with a decrease in avian fatalities compared to non-flashing, steady burning lights at tower systems. Gehring, et. al. further stated that "Removing non-flashing lights from towers is one of the most effective and economically feasible means of achieving a significant reduction in avian fatalities at existing communication towers." Because the proposed wind turbines would be taller than 61 meters (200 feet), NASA would utilize either red or white flashing light systems.

NASA would collaborate with CNWR in monitoring Wallops Island for piping plover activity. CNWR personnel routinely monitor Assateague, Wallops Island, Assawoman, and Metompkin Island beaches for piping plovers during nesting season. NASA field personnel would monitor Wallops Island for piping plover activity. The location of any nests discovered would be recorded with a Global Positioning System (GPS) unit, identified with signage, and closed to personnel or visitor access. This information would be used to determine when piping plovers are actually migrating to and from their nesting sites.

In addition to the plover nesting surveys, NASA would institute mortality surveys around the base of each turbine after the turbine construction is completed. Takes of piping plovers would be noted and reported to USFWS. Data from these surveys would be used to assess the impact of the proposed project to the plovers and serve as the basis for adaptive mitigation techniques.

Concurrently, educational signs would be posted at all beach access points to raise awareness of the species and to provide contact information. Basic species identification would be included in the natural resources training module of the WFF Environmental Management System (EMS), a requirement of all new employees at the facility. WFF would continue to distribute its annual piping plover nesting announcement; this annual message is sent to all WFF employees informing them of the potential for encountering the protected species.

4.1.3 Conclusion

The year-long avian and bat impact study showed no evidence that piping plovers frequent the action area (NASA, 2010.); the point count surveys conducted from 2008-2009 recorded no piping plovers at or in the proximity of the action area. Similarly, no carcasses of piping plovers were found in the surrogate tower mortality surveys (NASA, 2010). Observations suggest that impacts from the wind turbines on nesting piping plovers would be minimal. The action area is not in plover foraging or nesting habitat so habitat loss is not an effect. Construction noise and concomitant startle effects can be considered to be negligible as well. USFWS Guidelines for fireworks and piping plovers recommend a 1.2 km (0.75 mile) buffer between nesting plovers and pyrotechnic displays. Construction noise levels are approximately 40 decibels less than pyrotechnics and would be 4 times as far away. Operational effects to nesting plovers should be minimal as well. As discussed in Section 4.1.1, nesting plovers rarely fly above 10 meters (33 feet) However, given the scarcity of information concerning migrating plover flight paths, the possibility that the flight path of the piping plovers may take them over the action area at an altitude that would intersect the rotor-swept zone cannot be discounted. Because piping plover mortality may result as a consequence of collisions with the rotating blades, NASA concludes that the proposed action may affect, and is likely to adversely affect, the piping plover due to a small likelihood of collision with the turbine blades.

4.2 Red Knot

4.2.1. Direct and Indirect Effects

Red knots would be expected to be present in areas suitable for piping plover nesting during similar times of the year. Under the Proposed Action, the wind turbines and access roads would be constructed on the opposite side of the island from the preferred red knot foraging areas. As the barrier islands are purely a stopover point on their migratory path to breeding grounds in the high Arctic, there would be no impact on red knot breeding activity.

Noise from construction activities would be of short duration and would likely present minor startle reactions. Temporary interruption of foraging activities for red knots may occur as a result of human presence during staging and construction activities.

Operations under the proposed action could result in red knot mortality as a result of collision with the wind turbine blades, however studies have suggested that such occurrences would be rare. Although no red knot avoidance data is available, rates calculated at a few existing wind farms in the U.S. where mainly geese and raptor species were estimated to have avoidance rates greater than 95 percent. Fernley et al. (2006) calculated the avoidance rates of geese at four land-based wind farms in the U.S. using the Band Collision Risk Model. The avoidance rates calculated at the four facilities ranged from 99.82 percent to 100 percent despite high use by geese at these wind farm sites.

4.2.2 Actions to Reduce Adverse Effects

Under the Proposed Action, the wind turbines and access roads would be constructed on the opposite side of the island from the preferred habitat and foraging sites. No construction is planned for areas within known habitat. Noise from construction activities would be of short duration and would likely present minor, if any, startle reactions. Therefore no attempt would be made to reduce adverse effects to red knots from construction activities.

NASA would collaborate with CNWR and U.S. Department of Agriculture (USDA) personnel in monitoring Wallops Island for red knot activity. This monitoring would be concurrent with piping plover monitoring. Any identification of the species within the area would be documented and reported to the appropriate federal and state agencies. This information would be used to determine when red knots are actually present on Wallops Island.

In addition to the monitoring surveys, NASA would institute mortality surveys around the base of each turbine after the turbine construction is completed. Takes of red knots would be noted and reported to USFWS. Data from these surveys would be used to assess the impact of the proposed project to the red knots and serve as the basis for adaptive mitigation techniques.

As stated in Section 4.1.2, NASA would utilize either red or white flashing obstruction light systems on the wind turbines to reduce the risk of avian (including red knot) fatalities.

Additionally, educational signs would be posted at all beach access points to raise awareness of the red knot and to provide contact information. Basic species identification would be included in the natural resources training module of the WFF Environmental Management System (EMS), a requirement of all new employees at the facility. WFF would continue to distribute its annual piping plover nesting announcement. This annual message is sent to all WFF employees informing them of the potential for encountering protected species, including red knots.

4.2.3. Conclusion

The year-long avian and bat impact study showed no evidence that red knots frequent the action area (NASA, 2010.); the point count surveys conducted from 2008-2009 recorded no red knots at or in the proximity of the action area. Similarly, no carcasses of red knots were found in the surrogate tower mortality surveys (NASA, 2010). Moreover, observational data demonstrates that red knots on Wallops Island congregate on the opposite side of the island, approximately 4.3 km (3 miles) from the action area. It is reasonable to conclude that risk to red knots from the operation of the wind turbines is like to be small. However, it is not unknown for red knots to forage in marsh areas. Based on the proposed marsh location of this project and the possibility that it may provide suitable foraging habitat for red knots at some point, it is possible that the flight path of birds would be affected by the wind turbines, and mortality may result as a consequence of collisions with the rotating blades. Therefore, NASA determines that the proposed action may affect, and is likely to adversely affect, the red knot due to a small likelihood of collision with the turbine blades.

5. Cumulative Effects

The conclusions in this BA are based on the best scientific and commercial data available and are intended to assist in reaching a determination regarding the effects to each species in the context of the formal consultation process and as rendered in a formal biological opinion. NASA is unaware of any state, tribal, local, or private actions that are reasonably certain to occur within the action area considered in this BA. Federal agencies own and manage the property in the action area. Therefore, NASA is not aware of any cumulative effects in this area.

6. References

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