FINDINGS AND RECOMMENDATIONS REGARDING THE PROPOSED ISSUANCE OF AN ENDANGERED SPECIES ACT SECTION 10(a)(1)(B) INCIDENTAL TAKE PERMIT FOR THE KAWAILOA WIND POWER HABITAT CONSERVATION PLAN FOR CONSTRUCTION AND OPERATION OF THE KAWAILOA WIND POWER FACILITY, OAHU, HONOLULU COUNTY, HAWAII

The U.S. Fish and Wildlife Service (Service) proposes to issue an Incidental Take Permit (ITP) to Kawailoa Wind Power, LLC (Kawailoa Wind Power or Applicant) under the authority of section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended (Act). The following documents were used in preparation of this statement of findings and recommendations and are incorporated by reference as described in 40 CFR §1508.13 (2011): (1) Kawailoa Wind Power's Final Habitat Conservation Plan (HCP) for the Construction and Operation of the Kawailoa Wind Power Generation Facility, Oahu, Hawaii (SWCA 2011a); (2) Kawailoa Wind Power's Final State of Hawaii Environmental Impact Statement for Kawailoa Wind Power (CH2M Hill 2011); (3) the Service's Final Environmental Assessment for this proposed permit action (SWCA 2011b); and (4) the Service's Biological Opinion on this proposed permit action (Service 2011). The decision record for these findings and recommendations is on file at the Service's Pacific Islands Fish and Wildlife Office (PIFWO) in Honolulu, Hawaii.

I. Description of the Proposed Action

The Applicant proposes to construct and operate a 70-megawatt (MW), 30-turbine commercial wind energy generation facility at Kawailoa in the northern portion of the island of Oahu, Hawaii. The proposed Kawailoa Wind Power project is located east of Haleiwa Town and south of Waimea Valley in the District of Waialua. The proposed project, known as Kawailoa Wind Power, is situated within an approximately 4,200-acre (1,700 ha) parcel of privately owned land that is zoned agricultural. Kawailoa Wind Power will supply wind-generated electricity to the Hawaiian Electric Company (HECO).

The Kawailoa Wind energy generation facility is bounded on all sides by agricultural lands. The western portion abuts residences seaward of Kamehameha Highway and military training land is present east of the property. All parcels are owned by Kamehameha Schools and designated as an Agricultural District. The primary access road is Kawailoa Road off Kamehameha Highway (Hwy 83). Construction of the proposed facilities will have a permanent footprint of 22 acres after disturbing approximately 335 acres of land. Approximately 259 acres of the disturbed area are likely to remain under long-term vegetation management due to the requirement to maintain search plot areas under turbines and two, permanent meteorological towers for downed wildlife monitoring. The proposed development primarily involves: (1) the construction and operation of 30 Siemens 2.3-megawatt (MW) wind turbine generators (WTGs), two permanent meteorological towers (met towers), two interconnection facilities, two communication towers, a maintenance building, a Battery Energy Storage

System (BESS), access roads, and an Operations and Maintenance (O&M) building; and implementation of the HCP. The project may also include installation, operation, and maintenance of up to four microwave dish antennae on two existing Hawaiian Telcom facilities near the summit of Mount Kaala. The communication equipment would provide a link between the wind farm and the existing HECO substations that would be receiving the electrical power.

Under the proposed permit action, Kawailoa Wind Power would be authorized to incidentally take six listed species that are endemic to Hawaii and may be adversely affected by the Kawailoa Wind Power project. Of the six listed species, five are birds: the threatened Newell's shearwater (*Puffinus auricularis newelli*), and the endangered Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alai*), Hawaiian moorhen (*Gallinula chloropus sandvicensis*), and Hawaiian duck (*Anas wyvilliana*). The sixth species is a mammal - the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*). These species are hereafter referred to as "covered species."

II. Analysis of Effects

The analysis of likely impacts of the Kawailoa Wind Power project to the covered species is based on the best scientific information presently available, including downed wildlife monitoring results collected at the Kaheawa Wind Power (KWP I) and Kahuku Wind Power projects post-construction since operations began in June 2006 (KWP 2008b, 2008c, KWP 2009, KWP 2010, Kahuku Wind Power 2011).

The following five groupings of take (i.e. injury and mortality) are analyzed in the Kawailoa Wind Power HCP: (1) direct take; (2) indirect take; (3) unobserved direct take; (4) unobserved indirect take; and (5) estimated total take. Although measures in the HCP and associated ITP describe how Kawailoa Wind Power seeks to avoid and minimize the risk of take of covered species to the greatest extent practicable, some take may be unavoidable. Therefore, Kawailoa Wind Power will mitigate for such take by implementing conservation actions to benefit the recovery of the listed species.

Kawailoa Wind Power's proposed mitigation measures were selected in collaboration with the Service, the State of Hawaii Department of Land and Natural Resources - Division of Forestry and Wildlife (DLNR-DOFAW), and, pursuant to Hawaii State law, the State of Hawaii Endangered Species Recovery Committee (ESRC). Because of some uncertainty regarding anticipated rates of take and the success of the proposed mitigation measures, Kawailoa Wind Power proposes a tiered approach to mitigation that incorporates adaptive management. Although the Tier 1 level of mitigation will be implemented initially, adaptive management will allow for changes in the level of mitigation as warranted. Mitigation efforts will increase to the progressive tiers if monitoring demonstrates that incidental take is occurring above higher tier levels up to the maximum amount of take allowed by the ITP. Mitigation project costs are estimated in the HCP.

If additional mitigation is warranted, mitigation efforts may be increased at an existing mitigation site or implemented at additional sites on Oahu, Maui, Kauai, or elsewhere. Selection of additional sites, identification of the appropriate mitigation initiatives, and level of effort will be approved by the Service and DLNR-DOFAW. If higher rates of take are found to occur annually and persist for more than three consecutive years, Kawailoa Wind Power will conduct on-site investigations in an effort to determine the cause(s) of the unexpectedly high level of take, and identify and implement measures to reduce take levels. If the mitigation actions are not successful, the Applicant has agreed to implement alternative mitigation based on the biology of the covered species and guided by the results of monitoring efforts. Any changes in mitigation efforts will be made only with the approval of the Service and DLNR-DOFAW.

The HCP establishes avoidance and minimization measures, and mitigation and adaptive management procedures to avoid exceeding the take limit for each covered species authorized by the ITP. Avoidance and minimization measures, mitigation and adaptive management procedures, and the effects of the proposed action on the covered species are analyzed in depth in the HCP and the Service's Biological Opinion on this proposed permit action, both of which are incorporated herein by reference.

Effects of the Action on the Covered Species

Activities that may affect the Covered Species in the project area include construction and operation of turbines and met towers, lighting, electrical collection lines, and implementation of HCP mitigation, monitoring, and adaptive management measures. However, take of covered species (except for the Hawaiian moorhen) is estimated only for collisions with WTGs, met towers, and collection lines because either the level of risk of take associated with the other activities is considered negligible or the measures and procedures that Kawailoa Wind Power plans to implement cause the level of risk of take to become negligible. Because the Hawaiian moorhen is susceptible to capture while conducting predator control, take has been authorized for this activity.

Newell's Shearwater

Species Background

The Newell's shearwater was listed as a threatened species by the Service in 1975 (Service 1983). Newell's shearwater was once abundant on all of the main Hawaiian islands. In 1995 the population estimate, based on at-sea surveys was 84,000 birds (Spear et al. 1995, p. 624), with approximately 90 percent of the population nesting on the island of Kauai. Newell's shearwater also breeds on several other of the main Hawaiian islands where they nest in mountainous terrain between elevations of 500 and 2,300 feet. This species is known to nest on the islands of Hawaii, Molokai, Lanai, and Maui. While the Newell's shearwater was once abundant on all Hawaiian islands, including Oahu, it is not currently confirmed as a nesting species on Oahu (Ainley et al. 1997).

Recent ornithological radar surveys, combined with returns of downed birds to the Save Our Shearwaters program, show an apparent decline of 75 percent in Newell's shearwater between 1993 and 2009 (Day et al. 2003, Holmes et al. 2009), resulting in a current population estimate of 21,000, with 18,900 on Kauai. The most recent population estimate of Newell's shearwater is approximately 20,000 birds (Pyle and Pyle 2009). Significant range reductions as well as an overall decline in distribution are documented, and at least three colonies documented as being active between 1980 and 1994 are now abandoned (Holmes et al. 2009). As with other long-lived species with low reproductive rates, population modeling has documented that the survival rate of breeding age adults has the biggest impact on the population (Griesemer and Holmes, 2010).

Population models incorporating best estimates of Newell's shearwater breeding effort and success yielded a population decreasing at a rate of 3.2 percent annually (Ainley et al. 2001, p. 118). When variables describing the anthropogenic mortality suffered by Newell's shearwater (predation, light attraction and collision) were included, these models predicted a population decline of 30 to 60 percent over 10 years (Ainley et al. 2001, p. 122).

The primary threats to the recovery of the Newell's shearwater are: (1) predation by non-native species; (2) habitat degradation and loss (including destruction of burrows by feral ungulates and an increase in non-native plants because of ungulates); (3) natural disturbance such as hurricanes and tsunamis; and (4) collisions induced by attraction to urban lighting. Loss of existing and potential nesting habitat due to clearing of forests for agriculture and urban development, mining of cinder cones, and recent volcanic eruptions on the island of Hawaii are among the terrestrial factors believed to be contributing to the decline of Newell's shearwater (Service 1983).

Estimated Take

To date, no Newell's shearwater fatalities have been observed at KWP I or Kahuku Wind Power. For the purpose of estimating fatality rates using data from the radar surveys Kawailoa Wind Power, used the 99% avoidance rate. Estimated average fatality rate at a 99% avoidance level for all turbines is estimated at 0.50 shearwaters/year. Shearwater fatality at the two permanent met towers is estimated at 0.01 shearwaters/year at the 99% avoidance rate. The total expected fatality for the turbines and met towers combined is calculated to be 0.51 shearwaters/year. However, this estimated fatality may be inflated because during the radar survey, it was evident that some of the targets observed on radar were likely not to be Newell's shearwater but other seabirds or shorebirds that have similar flight speeds and sizes, such as the Pacific golden-plover, black-crowned night heron or white-tailed tropic bird (SWCA 2011a Appendix 3; Day et al. 2003b). Coupled with the uncertainty over whether the species breeds on Oahu, Kawailoa Wind Power assumes that approximately only one-fourth of the radar targets observed were Newell's shearwater and projects a mortality rate of 0.13 shearwaters/year for all turbines and met towers on-site.

Based on the species' life history parameters, indirect take will likely occur at the rate of 0.46 eggs or chicks per adult taken between May and August, and 1.0 chick per adult taken in September through October. Because unobserved direct take for Newell's shearwaters may occur, the total annual direct take estimate is rounded to two birds. These are conservative adjustments because this assumes that a chick will definitely perish if either parent dies at any time through October. When chicks are close to fledgling, it is likely that some will survive even with the death of a parent, similar to other seabirds such as the Hawaiian petrel (Simons and Hodges 1998).

Because take may be distributed unevenly over the years, it is estimated that total direct take of up to three Newell's shearwaters and the total indirect take of up to two chicks for any given year for the duration of the project could occur. In addition to the annual rate of take, a 5-year and 20-year take limit based on the expected multi-year average rate of take are also displayed. This calculation does not use a multiple of the annual rate of take because the actual expected take will vary year to year. Table 1 shows authorized take rates and 20-year take limits that will be authorized by the ITP for the duration of the project.

Table 1. Authorized take at Tier 1 and Tier 2 levels for the Newell's Shearwater.

Tier	Annual Limit	5-Year Limit	20-Year Limit
Tier 1	3 adults/immatures 2 chicks/eggs	3 adults/immatures 2 chicks/eggs	3 adults/immatures 2 chicks/eggs
Tier 2	6 adults/immatures 3 chicks/eggs	6 adults/immatures 3 chicks/eggs	6 adults/immatures 3 chicks/eggs

The Tier 1 requested take is for five shearwaters over 20 years, which would result in an annual rate of take of shearwaters of 0.25 shearwaters per year, which is less than 0.002% of the current estimated Newell's shearwater population. If all five mortalities occur at once, it constitutes 0.02% of the estimated population. Given these very low percentages, take caused by the proposed project would not result in significant adverse effects to Newell's shearwater at the population level. Tier 2 requested take totals 9 shearwater over 20 years, resulting in an average annual rate of take of 0.5 shearwaters per year. This impact is less than 0.004% of the overall population. If all nine mortalities occur at once, it constitutes 0.04% of the estimated population. Given these very low percentages, take caused by the proposed project would not result in significant adverse effects to Newell's shearwater at the population level and with no known nesting colonies on Oahu effects to the population would be minimal. Even so, the effects of these impacts are expected to be temporary, but can expected to persist until the surviving member of a breeding pair is able to find a mate, or the net increase in fledglings produced achieve reproductive status (a minimum of 6 years).

The overall mitigation program provided in the HCP is expected to provide a net benefit to the recovery of the species through the development of a more efficient cat trap that will protect and enhance existing colonies on Kauai, where 90 percent of known nesting occurs, through the increased survival of breeding adults, increased nesting success, increased fledging success and increased available protected habitat. The contribution to a restoration fund for Newell's shearwater management to include actions such as predator control, social attraction or translocation of Newell's shearwaters will potentially create additional protected colonies on Kauai or within Maui Nui (Maui, Molokai, Lanai, and Kahoolawe).

Mitigation

Although providing mitigation on Oahu for most of the covered species would be preferred, this approach is not likely to be the most productive for Newell's shearwater recovery. No discrete nesting colonies are known from Oahu, and locating any small and likely scattered breeding populations, if any exist, would take considerable effort. Combined with additional threats, including high fallout potential due to heavy urbanization on Oahu, makes conservation efforts on a scale that is within the scope of this project impractical and likely ineffective in terms of contributing to recovery.

Tier 1 mitigation for the Kawailoa Wind Power project is funding the development of a self-resetting cat trap and deployment of the trap at a Newell's shearwater colony on Kauai. The development of a more efficient cat trap is consistent with one of the recovery milestones identified in the Recovery Plan for the Hawaiian Petrel and Newell's Shearwater (Service 1983) and the Five-Year Work Plan for Newell's Shearwater (NESH Working Group 2005).

For Tier 2 rates of take, Kawailoa Wind Power will contribute to a restoration fund for predator control, social attraction and translocation of Newell's shearwaters. Kahoolawe has been identified as a potential site where Kawailoa Wind Power would contribute $200,000 to the restoration fund.

Hawaiian Stilt

Species Background

The Hawaiian stilt was listed as an endangered species on October 13, 1970 (Service 1970), pursuant to the Endangered Species Preservation Act of 1966. Hawaiian stilts were historically known from all of the major Hawaiian Islands, except Lanai and Kahoolawe (Service 2005, p. 25). Stilts are now found on all of the main Hawaiian Islands except Kahoolawe. No historical estimate of Hawaiian stilt population size is available, but by the early 1940s, the statewide population was estimated to be between 200 and 1,000 birds (Service 2005, p. 25). However, these population estimates did not account for the Hawaiian stilts present on Niihau and are therefore considered underestimates. DOFAW has conducted biannual waterbird surveys since the 1950s. Though Hawaiian stilt census data show high year-to-year variability in the number of stilts observed (Service 2005, p. 28), long-term census data indicate that statewide populations have been relatively stable or slightly increasing. Currently, the population of Hawaiian stilts is considered to be stable to increasing (Service 2005, p. 28) and is estimated to be between 1,200 and 1,600 birds. DOFAW's biannual waterbird surveys detected between 500 and 2,000 individuals between 1986 and 2006. Because Hawaiian stilts readily disperse between islands they are considered a homogenous meta-population (Service 2005, p. 28).

The primary threats to the recovery of the Hawaiian stilts are: (1) the loss of wetland habitat, (2) predation by introduced animals, (3) disease, and (4) potentially environmental contaminants (Service 2005).

Estimated Take

No Hawaiian stilts were observed flying over the project area during the avian surveys. Consequently, modeling would result in an estimated take rate of zero because known stilt passage rate is zero. However, because Hawaiian stilts have historically occurred in the Kawailoa area, it is assumed that the project would be at some risk of taking this species. For the purposes of this HCP, the estimated rate of take of the Hawaiian stilt will be estimated to be an average of 0.17 stilts/year lost through interaction with turbines, met towers, on-site communication towers, and overhead cables, utility poles and other associated structures, as well as mortality due to construction-related fatalities and vehicular strikes.

Adult stilts are most likely to collide with turbines and associated structures during non-breeding periods or toward the end of their breeding period when chicks are larger and can be left unattended for longer periods of time. Hawaiian stilts are highly territorial during the breeding season (Robinson et al. 1999) and are much more likely to be defending their territories while incubating or attending to dependent young, and so are not expected to fly over the Kawailoa Wind Power site during those times. Hawaiian stilts breed from February to August.

For purposes of assessing indirect take, any adult Hawaiian stilt mortality recorded during the months of February through August will be assumed to have been actively breeding. Stilt mortality that occurs outside the breeding season will be assumed to be of non-breeding birds and will not be assigned any indirect take. Since both sexes provide fairly equal amounts of parental care, the amount of indirect take assessed will be shared equally between males and females. Parents have not been documented to feed their chicks, thus at least half the brood is assumed likely to survive even with the loss of one parent (Robinson et al. 1999). Based on these assumptions, the amount of indirect take assessed for each direct adult stilt mortality is 0.45 during the breeding season.

In addition to the annual rate of take, a 5-year and 20-year take limit based on the expected multi-year average rate of take are also displayed. This calculation does not use a multiple of the annual rate of take because the actual expected take will vary year to year. Table 2 shows authorized take rates and 20-year take limits that will be authorized under the ITP for the duration of the project.

Table 2. Authorized take at Tier 1 and Tier 2 levels for the Hawaiian stilt.

Tier	Annual Limit	5-Year Limit	20-Year Limit
Tier 1	4 adults/immatures 2 fledgling	6 adults/immatures 3 fledgling	8 adults/immatures 4 fledglings
Tier 2	4 adults/immatures 2 fledgling	8 adults/immatures 4 fledglings	12 adults/immatures 6 fledglings

Oahu supports 35 to 50 percent of the statewide Hawaiian stilt population, with approximately 560 to 800 birds present on the island. The take of 18 stilts in the highest tier, over 20 years is not expected to substantially impact the population on Oahu. If all 18 mortalities occur at once, it could constitute 2.3% of the estimated population on Oahu. However, the population is transitory and has been documented to travel between islands and maybe more appropriate to assess on statewide basis with a population of 1200 to 1600 which would comprise an effect of 1.1%. Given these very low percentages, take caused by the proposed project would not result in significant adverse effects to Hawaiian stilt at the population or species level.

Mitigation

Tier 1 mitigation for Kawailoa Wind Power is funding restoration of 40 acres of the 150 acre Ukoa Pond. Ukoa Pond is identified as a supporting wetland on Oahu in the Draft Revised Recovery Plan for Hawaiian Waterbirds (Service 2005). One of the downlisting criteria for the four endangered waterbird species is that 75% of the supporting wetlands are protected and managed according to the practices outlined in the recovery plan. Tier 2 mitigation for Kawailoa Wind Power is funding restoration of an additional 40 acres of Ukoa Pond. Restoration plans at Ukoa will include year-round predator trapping and baiting to remove predators (e.g., cats, mongoose, rats, dogs), and removal of predators by hunting to further reduce the threat of predation on the four covered waterbird species. Removal of undesirable plant species and establishment of native marsh plant species will enhance available nesting habitat for the four covered waterbird species. A long-term banding, nest monitoring and resight study will also be used to quantify productivity and mitigation success.

Hawaiian Coot

Species Background

The Hawaiian coot was listed as an endangered species on October 13, 1970 (Service 1970), pursuant to the Endangered Species Preservation Act of 1966. Hawaiian coots historically occurred on all of the main Hawaiian Islands except Lanai and Kahoolawe. Coots have typically been most numerous on Oahu, Maui, and Kauai (Service 2005, p. 12). Population estimates prior to the 1950s are not available; however, estimates from the late 1950s and early 1960s indicated a population of fewer than 1,000 birds.

Hawaiian coots currently inhabit all of the main Hawaiian Islands except Kahoolawe. An estimate of the island-wide population, based on biannual waterbird counts conducted by DOFAW, suggests that the population is stable and is estimated at between 1,500 to 3,000 individuals.

The primary threats to the recovery of the Hawaiian coots are: (1) the loss of wetland habitat, (2) predation by introduced animals, (3) disease, and (4) potentially environmental contaminants (Service 2005).

Estimated Take

Coots were not observed flying through the project area during the avian surveys but one Hawaiian coot was observed foraging once in an irrigation pond near the project site. The Hawaiian coot was absent in subsequent observations. Because the coot was not observed in flight, mortality modeling for this species would result in a projected rate of take of zero. Since the Hawaiian coot presumably took flight to arrive and depart from the pond, Hawaiian coots may occasionally occur in or near the airspace envelope of the turbines. Therefore, it seems the potential for take of this species occurring from the proposed project, while very low, is not zero. Therefore, as with Hawaiian stilt, for the purposes of the HCP, it will be assumed that the rate of take of Hawaiian coot will be the same as for all Hawaiian waterbirds, or an average of 0.17 coots/year resulting from interactions with turbines, met towers, on-site communication towers, associated overhead cables, utility poles and other associated structures, as well as mortality due to construction related fatalities and vehicular strikes.

It is assumed that adult coots are most likely to collide with turbines and associated structures during non-breeding periods when the birds could be making local or inter-island movements. Hawaiian coots are territorial during the breeding season (Polhemus and Smith 2005; Smith and Polhemus 2003) and are much more likely to be defending their territories while incubating or attending to dependent young, and so are not expected to fly over the Kawailoa Wind Power project area during those times. Hawaiian coots have been documented to breed year-round with the peak breeding period between March and September.

For purposes of assessing indirect take, any adult Hawaiian coot mortality recorded during the months of March through September will be assumed to have been actively breeding. However, as mentioned for other species, it is assumed that coots would not be flying at such distance from nesting locations unless their young were older and could be left alone for longer periods of time. Thus, for indirect take assessed to mortalities recorded from March to September, it will be assumed that such coots would have been tending to older chicks. It will be assumed that any coot found from October through February will have had a 25% chance of having been breeding actively and tending to older chicks. Since both sexes provide relatively equal parental care, the amount of indirect take assessed is equally shared between males and females. Older chicks are not fed but guided to food by their parents, thus at least half the brood is likely to survive even with the loss of one parent (Brisbin et al. 2002). Based on these assumptions, the amount of indirect take assessed for each direct adult coot mortality could range from 0.11 to 0.45 chicks, depending on the time of the year.

In addition to the annual rate of take, a 5-year and 20-year take limit based on the expected multi-year average rate of take are also displayed. This calculation does not use a multiple of the annual rate of take because the actual expected take will vary year to year. Table 3 shows authorized take rates and 20-year take limits that will be authorized under the ITP for the duration of the project.

Table 3. Authorized take at Tier 1 and Tier 2 levels for the Hawaiian coot.

Tier	Annual Limit	5-Year Limit	20-Year Limit
Tier 1	4 adults/immatures 2 fledgling	6 adults/immatures 3 fledgling	8 adults/immatures 4 fledglings
Tier 2	4 adults/immatures 2 fledgling	8 adults/immatures 4 fledglings	12 adults/immatures 6 fledglings

Oahu supports between 500 to 1,000 coots, or up to 33 percent of the statewide population. The take of 18 coots, over 20 years is not expected to substantially impact the population on Oahu. If all 18 mortalities occur at once, it would constitute 1.89% of the estimated population on Oahu. However, the population is transitory and has been documented to travel between islands and maybe more appropriate to assess on statewide basis with a population of 1,500 to 3,000 which would comprise an effect of 0.6%. Given these very low percentages, take caused by the proposed project would not result in significant adverse effects to Hawaiian coot at the population or species level.

Mitigation

Tier 1 mitigation for Kawailoa Wind Power is funding restoration of 40 acres of the 150-acre Ukoa Pond. Ukoa Pond is identified as a supporting wetland on Oahu in the Draft Revised Recovery Plan for Hawaiian Waterbirds (Service 2005). One of the downlisting criteria for the four endangered waterbird species is that 75% of the supporting wetlands are protected and managed according to the practices outlined in the recovery plan. Tier 2 mitigation for Kawailoa Wind Power is funding restoration of an additional 40 acres of Ukoa Pond. Restoration plans at Ukoa will include year-round predator trapping and baiting to remove predators (e.g., cats, mongoose, rats, dogs), and removal of predators by hunting to further reduce the threat of predation on the four covered waterbird species, including the Hawaiian coot. Removal of undesirable plant species and establishment of native marsh plant species will enhance available nesting habitat for the four covered waterbird species. A long-term banding, nest monitoring and resight study will also be used to quantify productivity and mitigation success.

Hawaiian Moorhen

Species Background

The Hawaiian moorhen was listed as an endangered species in 1967 (Service 1970), pursuant to the Endangered Species Preservation Act of 1966. No historical population estimates are available for the endemic Hawaiian moorhen. Because they are secretive birds, it is difficult to conduct population surveys for this species. It is believed that they were common on the main Hawaiian Islands, except Lanai and Kahoolawe, in the 1800s but radically declined by the mid-1900s. Surveys from the 1950s through the 1960s estimated only 57 individuals. Currently, Hawaiian moorhen inhabit the islands of Kauai and Oahu (Service 2005, p. 19). Island-wide population estimates, based on biannual waterbird counts conducted by DOFAW, suggests that the population is increasing, but count numbers are variable. DOFAW's biannual waterbird surveys detected between 80 and 450 individuals between 1986 and 2006. However, these survey numbers are thought to be underestimates because of the moorhen's cryptic behavior. Standard survey methods in these counts include visual and aural detection. Recent research conducted by DesRochers (2008) in 2005 through 2007 has shown that passive surveys of cryptic waterbirds underestimate numbers of individuals present in the wetlands. Alternatively, broadcasting vocalizations of cryptic waterbirds to elicit responses increases detection. On average his research has shown that broadcasting calls increased moorhen detection by 30 percent.

The primary threats to the recovery of the Hawaiian moorhen are: (1) the loss of wetland habitat, (2) predation by introduced animals, (3) disease, and (4) potentially environmental contaminants (Service 2005).

Estimated Take

Hawaiian moorhens were not detected at Kawailoa Wind Power during the year long avian point count survey but do occur in the nearby water bodies. However, Hawaiian moorhen are also thought to be at very low risk of collision with turbines because of their sedentary habits. For the same reasons discussed for Hawaiian stilt and Hawaiian coot, risk of collision by this species is not zero, and will be assumed to occur at the same rate assumed for those species, an average of 0.17 moorhens/year as a result of collision with turbines, met towers, on-site communication towers, associated overhead cables, utility poles and other associated structures, as well as mortality due to construction related fatalities and vehicular strikes and potentially from trapping.

Like Hawaiian coots, it is assumed that adult moorhens are most likely to collide with turbines and associated structures during non-breeding periods or, possibly, toward the end of their breeding period when chicks are larger and can be left unattended for longer periods of time. Hawaiian moorhen are territorial during the breeding season (Polhemus and Smith 2005; Smith and Polhemus 2003) and are much more likely to be defending their territories while incubating or attending to heavily dependent young, and so are not expected to fly over the Kawailoa Wind Power project area during those times. Hawaiian moorhen have been documented to breed year-round with the peak breeding period between March and August.

For purposes of assessing indirect take, any adult Hawaiian moorhen mortality recorded during the months of March through August will be assumed to have been actively breeding. It will be assumed that any moorhen found from September through February will have had a 25% chance of having been breeding and tending to older chicks. Since both sexes provide relatively equal parental care, the amount of indirect take assessed is equally shared between males and females. Older chicks forage with adults, feeding themselves the majority of the time, thus at least half the brood is likely to survive even with the loss of one parent (Bannor and Kiviat 2002). Based on these assumptions, the amount of indirect take assessed for each direct adult moorhen mortality ranges from 0.16 to 0.65 fledglings depending on the time of the year.

On July 7, 1994 an adult Hawaiian moorhen was found dead in one of the traps at Hanalei National Wildlife Refuge (NWR). In November 1994 one adult and three juvenile moorhens were discovered in one of the traps at Hanalei NWR and released unharmed. There is a high likelihood that Hawaiian moorhen will be accidentally trapped in the predator live traps due to the higher densities on Oahu and the inquisitive nature of these birds. The trapability of moorhen is further demonstrated by a study conducted in 2005 through 2007, by David DesRochers and Oahu NWR Complex staff, as part of his doctoral program at Tufts University, Massachusetts. The program was designed to begin banding this species for a cooperative project on improving population estimates of Hawaiian moorhen with call response surveys and banding data (DesRochers et al. 2008). Within a two-year time period, 90 Hawaiian moorhen were banded with 162 captures and recaptures with no recorded injuries or mortalities. The birds are naturally attracted to the traps. Therefore, Hawaiian moorhen may be captured in live traps which could result in injury or mortality. Indirect effects on loss of nests and chicks are less likely due to the basic life history of the species. Moorhen nest in dense vegetation, both sexes incubate for up to 20 days, and brood their young for about 48 hours (DesRochers 2010 p. 21). They are semi-precocial and are almost entirely independent within three weeks. The temporary capture is not likely to result in loss of eggs or chicks. The trapping at Ukoa Pond is anticipated a total of take of 50 individuals over the 20-year term of the ITP in the form of capture.

In addition to the annual rate of take, a 5-year and 20-year take limit based on the expected multi-year average rate of take are also displayed. This calculation does not use a multiple of the annual rate of take because the actual expected take will vary year to year. Table 4 shows authorized take rates and 20-year take limits that will be authorized under the ITP for the duration of the project.

Table 4. Authorized take at Tier 1 and Tier 2 levels for the Hawaiian moorhen.

Tier	Annual Limit	5-Year Limit	20-Year Limit
Tier 1	4 adults/immatures 2 fledgling	6 adults/immatures 3 fledgling	8 adults/immatures 4 fledglings
Tier 2	4 adults/immatures 2 fledgling	8 adults/immatures 4 fledglings	12 adults/immatures 6 fledglings

Biannual waterbird surveys record an average of 341 moorhens throughout the state (Service 2005). This average is only an index rather than a population size estimate, as common moorhens are secretive and difficult to census (Service 2005). The take of 18 moorhen caused by the proposed action, over 20 years is not expected to substantially impact the population on Oahu. If all 18 mortalities occur at once, it constitutes 5.3% of the estimated population on Oahu. Based on data collected by DesRochers (2008), because survey methods that were ineffective for detecting this secretive bird, the population is larger. It is unlikely that this action would result in this level of take at a single period in time; therefore, take caused by the proposed project over 20 years would not result in significant adverse effects to Hawaiian moorhen at the population or species level.

Mitigation

Tier 1 mitigation for Kawailoa Wind Power is funding restoration of 40 acres of the 150 acre Ukoa Pond. Ukoa Pond is identified as a supporting wetland on Oahu in the Draft Revised Recovery Plan for Hawaiian Waterbirds (Service 2005). One of the downlisting criteria for the four endangered waterbird species is that 75% of the supporting wetlands are protected and managed according to the practices outlined in the recovery plan. Tier 2 mitigation for Kawailoa Wind Power is funding restoration of an additional 40 acres of Ukoa Pond. Restoration plans at Ukoa will include year-round predator trapping and baiting to remove predators (e.g., cats, mongoose, rats, dogs), and removal of predators by hunting will reduce the threat of predation on the four covered waterbird species. Removal of undesirable plant species and establishment of native marsh plant species will enhance available nesting habitat for the four covered waterbird species. A long-term banding, nest monitoring and resight study will also be used to quantify productivity and mitigation success.

Hawaiian Duck

Species Background

The Hawaiian duck was listed as an endangered species in 1967 (Service 1970), pursuant to the Endangered Species Preservation Act of 1966. Historically, Hawaiian ducks occurred on all the main Hawaiian Islands except for Lanai and Kahoolawe. There are no population estimates prior to 1940, but in the 1800s they were fairly common in natural and farmed wetland habitats (Service 2005, p. 4). In 1949, an estimated 500 Hawaiian ducks remained on Kauai, and about 30 on Oahu. They were considered an occasional visitor to the island of Hawaii, and were presumed to be extirpated on Maui and Molokai (Service 2005, p. 5). By 1960, they were presumed extirpated from Oahu. From the 1950s through the early 1990s Hawaiian ducks were reintroduced to Oahu, Maui and Hawaii through a captive propagation and release program. Hawaiian ducks are currently found in wetland habitats on all the main Hawaiian Islands except for Kahoolawe; populations on all islands except for Kauai originated from reintroduced birds. On Kauai, populations are found primarily in Hanalei NWR and montane streams. The Hawaiian duck population is estimated to be approximately 2,000 individuals, but this is a best guess, with 80 percent of individuals occurring on Kauai (Engilis et al. 2002, p. 11). State biannual waterbird survey data count numbers range from 300 to 500 individuals. Because of the remoteness and inaccessibility of some habitats, the State waterbird counts are likely an underestimate. In addition, the impact of hybridization with feral mallards is variable between islands, and because it is difficult to distinguish between Hawaiian ducks, female mallards, and hybrids, the data collected from DOFAW's biannual waterbird surveys should be interpreted with care.

The most important current threat to the Hawaiian duck is hybridization with non-native mallards (Service 2005, p. 11). This is especially problematic on Oahu where most of the individuals are hybrids. In addition, feral pigs (*Sus scrofa*) and goats (*Capra hircus*) significantly reduce the suitability of nesting habitat for Hawaiian ducks along montane streams. Recovery of the Hawaiian duck would include removing the threat of hybridization to Hawaiian duck populations on Kauai, Niihau, Oahu, and Hawaii; and reestablishing Hawaiian duck populations on Maui and Molokai (Service 2005, p. 73). The Hawaiian duck shares the other primary threats to the recovery of the Hawaiian waterbirds: (1) the loss of wetland habitat, (2) predation by introduced animals, (3) disease, and (4) environmental contaminants (Service 2005).

Estimated Take

Given that few Hawaiian ducks are believed to be resident on the island of Oahu (Browne et al. 1993; Uyehara et al. 2007; Service 2005), all ducks that resembled pure Hawaiian ducks seen on the project site and in the project vicinity were assumed to be Hawaiian duck-mallard hybrids (see SWCA 2011a Section 3.8.4.3 for a detailed explanation). Nine such individuals were observed at point counts within the project area during the year-long avian survey. This results in an average passage rate of 0.054 individuals/hr/ha. Given the dispersal capabilities of the species, it is possible for pure Hawaiian ducks to occasionally fly over from Kauai. In addition, genetic research in 2007 showed presence of several Hawaiian ducks at James Campbell NWR, and a bird struck by a plane at Honolulu International Airport in 2005 was found to be Hawaiian duck (Wright 2008). Browne (1993) found absence of pure Hawaiian ducks on Oahu due to extensive hybridization with feral mallards. Uyehara et. al (2007) found a predominance of hybrids on Oahu. An estimated 300 Hawaiian duck-like birds are found on Oahu, but the majority of these, given the genetic evidence, are thought to be hybrids (Service 2005). Mallard control and possible reintroduction of Hawaiian ducks to Oahu may increase the population of Hawaiian ducks on the island within the 20-year life of the project. Given the very high proportion of hybids present on Oahu, it is conservatively assumed that only 10% of the ducks seen may have the potential to be pure Hawaiian ducks, although the proportion of pure Hawaiian ducks to Hawaiian duck-mallard hybrids is expected to be much less as described above. Thus the expected fatality rate of pure Hawaiian ducks is projected to occur at one-tenth the rate of Hawaiian duck-mallard fatalities at 0.017 ducks/year.

It is assumed that adult pure Hawaiian ducks are most likely to collide with turbines and associated structures during non-breeding periods or toward the end of their breeding period when ducklings are larger and can be left unattended for longer periods of time. Breeding adults are expected to be much more likely to remain in their home ranges while incubating or attending to dependent young, and so are not expected to fly over the Kawailoa Wind Power site during those times. It is assumed that pure Hawaiian ducks, like hybrid Hawaiian ducks will breed year-round, with a peak in breeding occurring from March to June.

For purposes of assessing indirect take, any adult pure Hawaiian duck mortality recorded during the months of March through June will be assumed to have been actively breeding. It will be assumed that any ducks found from July through February will have had a 25% chance of breeding actively and tending to older ducklings. It is also assumed that death of a male adult will not to lead to indirect death of ducklings because the males do not provide any parental care for eggs or ducklings. Based on these assumptions, the amount of indirect take that would be assessed for each direct adult duck mortality ranges from 0.00 to 1.225 ducklings, depending on time of year and gender of the fatality.

In addition to the annual rate of take, a 5-year and 20-year take limit based on the expected multi-year average rate of take are also displayed. This calculation does not use a multiple of the annual rate of take because the actual take will vary year to year. Table 5 shows authorized take rates and 20-year take limits that will be authorized under the ITP for the duration of the project.

Table 5. Authorized take at Tier 1 and Tier 2 levels for the Hawaiian duck.

Tier	Annual Limit	5-Year Limit	20-Year Limit
Tier 1	4 adults/immatures 4 fledgling	4 adults/immatures 4 fledgling	4 adults/immatures 4 fledglings
Tier 2	4 adults/immatures 4 fledgling	6 adults/immatures 6 fledglings	6 adults/immatures 6 fledglings

An estimated 300 hybrid Hawaiian ducks are present on Oahu (Engilis et al. 2002, Service 2005). Because it is anticipated that all hybrid Hawaiian ducks on Oahu will ultimately be removed or relocated to allow for the reintroduction of pure Hawaiian ducks, the control of hybrids at Ukoa Pond under the HCP will support the conservation role of the action area for the Hawaiian duck by contributing to the control of hybridization, the major threat to this species' recovery. In addition, restoring wetlands within the action area under the proposed HCP at a scale that adequately considers the life history requirements of this species is also beneficial to the recovery of the Hawaiian duck because an increase in breeding habitat is one of its conservation needs.

Mitigation

The Applicant will manage Ukoa Pond to remove hybrids. Strategies for implementing culling will be outlined in the Management Plan for Ukoa Pond and will be approved by Service and DOFAW prior to implementation. Tier 1 mitigation for Kawailoa Wind Power is funding restoration of 40 acres of the 150-acre Ukoa Pond. Ukoa Pond is identified as a supporting wetland on Oahu in the Draft Revised Recovery Plan for Hawaiian Waterbirds (Service 2005). One of the downlisting criteria for the four endangered waterbird species is that 75% of the supporting wetlands are protected and managed according to the practices outlined in the recovery plan. Tier 2 mitigation for Kawailoa Wind Power is funding restoration of an additional 40 acres of Ukoa Pond. Restoration plans at Ukoa will include year-round predator trapping and baiting to remove predators (e.g. cats, mongoose, rats, dogs), and removal of predators by hunting to further reduce the threat of predation on the four covered waterbird species. Removal of undesirable plant species and establishment of native marsh plant species will enhance available nesting habitat for the four covered waterbird species.

Hawaiian Hoary Bat

Species Background

The Hawaiian hoary bat was listed as endangered on October 13, 1970, under the Endangered Species Conservation Act of 1969. The Hawaiian hoary bat is endemic to the State of Hawaii where it is the only existing, native terrestrial mammal. The Hawaiian hoary bat is known to reside on Hawaii, Maui, Oahu, Lanai, Molokai and Kauai, with the largest populations likely on Hawaii and Kauai. There are no population estimates for the Hawaiian hoary bat and few historical or current records. Unsubstantiated population estimates across the State have ranged from hundreds to a few thousand individuals (Service 1998, p. 14). Data are limited because no feasible method currently exists for surveying the abundance and distribution of solitary, tree-roosting bats. The Hawaiian hoary bat's distribution may be broader than indicated by the current limited information resulting from localized search efforts (Service 1998, p. 14).

Hawaiian hoary bats have been observed year-round in a wide variety of habitats and elevations below 7,500 ft. (2,286 m), and a few sightings from limited surveys have been reported as high as 13,199 ft. (4,023 m). Hawaiian hoary bats have been detected in both wet and dry areas of Hawaii but seem to be more abundant on the drier leeward side (Jacobs 1994, p. 199) and generally less abundant in wet areas (Kepler and Scott 1990, p. 62). Only three researchers have examined spatial and temporal variation in occurrence patterns of bats in Hawaii, with conflicting conclusions about possible altitudinal or regional migration (Jacobs 1994, pp. 193-200; Menard 2001, pp. 1-149; Tomich 1986, pp. 1-30).

While detailed information is lacking, threats are assumed to be the same as those that threaten many bat species in general: (1) habitat loss (availability of roost sites); (2) mortality of breeding age adults coupled with slow reproductive rate; (3) collisions with vehicles and other structures; (4) pesticide use (either directly or by impacting prey species); (5) predation by native hawks and nonnative feral cats; and (6) lack of prey availability due to introduction of nonnative insects. Because Hawaiian hoary bats roost in trees, roost disturbance is also a likely threat (Service 1998).

Hoary bats also can be impaled on barbed wire in the continental United States (Anderson 2002; Iwen 1958, p. 438; Wisely 1978, p. 53) and in Hawaii (Burgett 2009, pers. comm.; Jeffrey 2007, pers. comm.; Mansker 2008, pers. comm.; Marshall 2008, pers. comm.) Fences with a top strand of barbed wire can entangle Hawaiian hoary bats during daily foraging activities and during seasonal migrations. Entanglement generally results in mortality of the bat. For fences that have been monitored, estimates of bat mortality range from zero bats caught on a forty-four mile fence at the Hakalau National Wildlife Refuge for the period between 1987 and 2007, to twelve bats caught on a fifty-two-mile fence at Haleakala Crater at Haleakala National Park for the period between 1986 and 2004 (Jeffrey 2007, pers. comm.).

In their Northern American range, hoary bats are known to be more susceptible to collision with wind turbines than most other bat species (Johnson et al. 2003; Erickson 2003; Johnson 2005). Most mortality has been detected during the fall migration period. Hoary bats in Hawaii do not migrate in the traditional sense, although some seasonal altitudinal movements occur. Currently it is not known how susceptible Hawaiian hoary bats are to turbine collisions, however; two Hawaiian hoary bat mortalities were observed at KWP I in six years of operation and one bat mortality at Kahuku Wind Power Facility in the first year of operation.

Estimated Take

Extensive monitoring of bat activity at existing wind farms on the continental U.S. has shown that bats are most susceptible to collisions with turbines during the fall migration season. In recent years, bat fatality studies have focused exclusively on a three month window (July through September) when most bat fatalities occur. Studies on documented bat fatalities outside this season are few and fatality rates appear to be minimal (Gruver 2002; Nicholson et al. 2005; Johnson et al. 2003a; Fiedler 2004). Several studies have also shown a positive relationship between the total number of bat passes/detector night (recorded primarily during the fall migration season) with the estimated total fatalities/turbine/year (Kunz et al. 2007; Baerwald and Barclay 2009).

Data from Kunz et al. (2007) show that the estimated number of bat fatalities/turbine/year is generally equivalent to the number of bat passes/detector night on site. A similar relationship was detected by Baerwald and Barclay (2009), where bat activity rates of migratory bats (of which the continental hoary bat is one) measured during the fall migration season, were positively correlated with fatality rates occurring at tall turbines (turbine towers 65 m or taller). The number of bat fatalities ranged widely from 1.7 to 13.5 times the number of migratory bat passes/detector night. The lowest bat activity rate recorded at their sampled sites was 0.78 ± 0.12 passes/detector night. This rate is more than five times greater than the rate recorded at Kawailoa Wind Power during the higher activity periods.

Therefore, using the Baerwald and Barclay (2009) study as a guide, bat fatality rates at tall turbine sites with low bat activity were examined in order to develop an estimate of expected direct take of Hawaiian hoary bats for Kawailoa Wind Power. The two sites (sites 8 and 9) with bat activity less than two bat passes/detector night, (Figure 1) most closely approaching that measured at Kawailoa also had bat activity rates that most closely matched adjusted bat fatality rates (i.e., in the range close to 1.7 times rather than 13.5 times). A similar trend is also seen in Table 6 with data summarized by Kunz et al. (2007). Sites with the lowest bat activity had a low ratio of fatality to activity, while sites with higher activity rates have more variable ratios of activity to fatality.

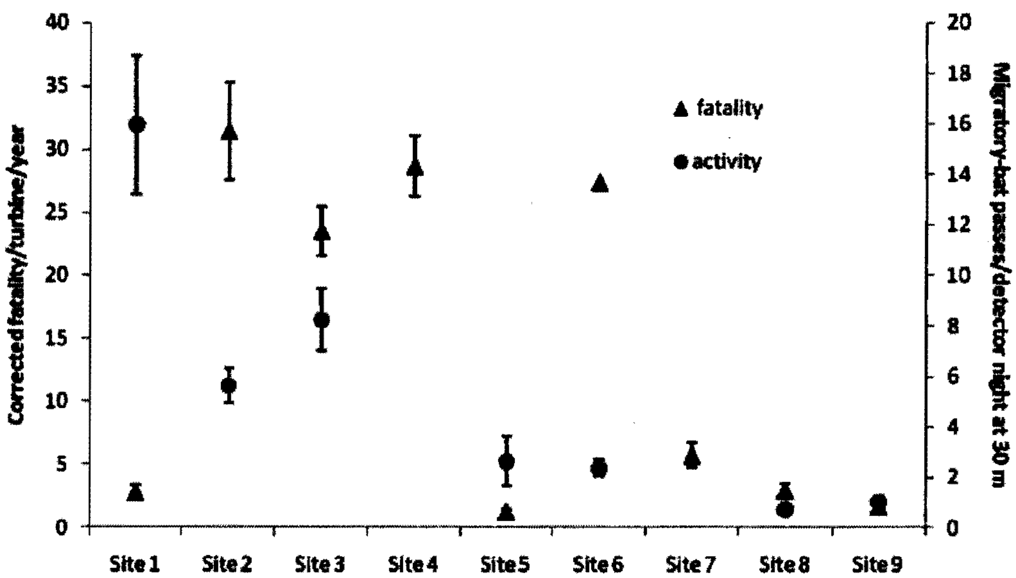

Figure 1. Mean ± SE Activity of Migratory Bats at 30 m and Corrected Bat Fatalities/Turbine/Year Across Sites in Southern Alberta, Canada.

Table 6. Bat fatality rates and activity indices at five wind-energy facilities on the mainland United States (from Kunz et al. 2007).

Study site	Dates of study	Bat mortality (no./turbine/yr)	Bat activity (no./detector/night)	Detector-nights	Source
Mountaineer, WV	31 Aug- 11 Sep 2004	38	38.2	33	E.B. Arnett, Bat Conservation International, unpubl. data
Buffalo Mountain, TN	1 Sep 2000- 30 Sep 2003	20.8	23.7	149	Fiedler 2004
Top of Iowa, IA	Sep to Oct 2003, May to Sep 2004	10.2	34.9	42	Jain 2005
Buffalo Ridge, MN	15 June-15 Sep 2001, 2002	2.2	2.1	216	Johnson et al. 2004
Foote Creek Rim, WY	1 Nov 1998- 31 Dec 2000	1.3	2.2	39	Gruver 2002

In an effort to minimize bat fatalities, low wind speed curtailment (LWSC) of 5 meters/second will also be implemented from the start of project operations for the peak months of March through November when bat activity is relatively higher (see SWCA 2011a Section 3.8.4.4). LWSC reduced bat fatalities by an average of 82% in 2008 and 72% in 2009, during a two-year study in Pennsylvania (Arnett at al. 2010). The expected fatality at Kawailoa with low wind speed curtailment assumed a conservative 70% reduction in fatalities during the implementation of LWSC.

The Anabat detectors used on-site resulted in measurement of an average of 0.15 passes/detector night during the higher activity periods (from March through November). Bat fatality at Kawailoa Wind Power was estimated using bat activity to fatality ratios ranging from 1:0.5 to 1:1.5 to encompass the uncertainty surrounding the susceptibility of resident Hawaiian hoary bats to turbine collisions as compared to their mainland counterparts. A ratio of 1:0.5 assumes that the Hawaiian hoary bat is somewhat less susceptible to turbine collisions than mainland bats due to factors such as a lack of long-distance mass migration behavior, though a much shorter distance altitudinal shift may occur on Oahu. Ratios of 1:1 and 1:1.5 assume that Hawaiian hoary bats are as susceptible to turbine collisions as the continental subspecies.

The expected bat fatalities based on the different assumed ratios. As an example when a 1:0.5 ratio is assumed, a bat activity rate of 0.15 passes/detector night results in 0.075 fatalities/turbine/yr, or 45 fatalities for 30 turbines over 20 years (=0.15 x 0.5 x 30 x 20). A 70% reduction in fatality due to LWSC is then applied resulting in an expected take of 13.5 bats for 30 turbines over the life of the project.

For the purposes of the HCP it will be assumed that all Hawaiian hoary bats taken through "unobserved direct take" will be adults and will have a 50% chance of having been female (based on the sex ratio of males to females during the breeding season). In addition, because bats most likely would be flying through the project area from March through November, spanning a period of nine months, the likelihood of a female bat having dependent young is assumed to be 11%. This is based in the information that Hawaiian hoary bats have one brood a year, and are expected to be to have dependent young one month out of the nine months (parental care of one month after birth; NatureServe 2008) present on site. Further, parental care is limited to a period June through September. Consequently, indirect take will be assessed to bats lost through "unobserved direct take" at the rate of 0.1 juveniles/bat (0.5 x 0.11 x 1.8 = 0.10).

A 5-year and 20-year take limit based on the expected multi-year average rate is displayed. This calculation does not use a multiple of the annual rate of take because the actual expected take will vary year to year. Table 7 shows authorized take rates and 20-year take limits that will be authorized under the ITP for the duration of the project.

Table 7. Authorized take at Tier 1, Tier 2, and Tier 3 levels for the Hawaiian hoary bat.

Tier	Annual Limit	5-Year Limit	20-Year Limit
Tier 1	8 adults and 4 juveniles	16 adults and 8 juveniles	16 adults and 8 juveniles
Tier 2	16 adults and 8 juveniles	24 adults and 12 juveniles	32 adults and 16 juveniles
Tier 3	24 adults and 12 juveniles	32 adults and 16 juveniles	48 adults and 24 juveniles

Mitigation

Habitat mitigation for Kawailoa Wind Power at Tier 1 consists of restoring 40 acres of wetland habitat or 400 acres of native forest to improve foraging resources available to bats and to provide additional roost trees, along with a complimentary research project that evaluates the efficacy of the mitigation method selected. Restoration will include year-round predator trapping and baiting to remove predators (e.g. cats, mongoose, rats, dogs), and removal of predators will reduce the threat of predation. Research will also be conducted to identify bat habitat utilization patterns and bat interactions at Kawailoa Wind Power. Either wetland or forest restoration will be conducted on the island of Oahu. If after five years it is determined that the restoration is insufficient to meet Tier 1 obligations, then additional wetland restoration or forest restoration or other newer management measures will be conducted to offset the deficit, with agency approval.

Tier 2 and Tier 3 mitigation consist of additional wetland acreage or forest restoration dependent on research outcomes that prove effective mitigation. The restoration may be modified depending on the outcome of the research that was conducted in Tier 1. The 40 acres of wetland or 400 acres of forest habitat restoration is expected to increase and improve bat foraging and roosting habitat which will lead to increased adult and juvenile survival and increased productivity to mitigate for the impacts to the population at Tier 2 or 3. Mitigation will be deemed successful based on the same criteria established for the respective mitigation measure in Tier 1, with improvements incorporated as determined by the research conducted in Tier 1. Mitigation measures may also be extended beyond the term of the ITL/ITP if necessary to compensate for the requested take. For these reasons, no adverse impacts to the species' overall population are anticipated.

III. Public Comment

The Service determined that the HCP qualifies for an environmental assessment (EA) under the National Environmental Policy Act (NEPA), as provided by the Department of Interior Manual (516 DM 6, Appendix 1). The EA was made available for public review through publication of a Notice of Availability of an EA and receipt of an application for a Permit published in the *Federal Register* on August 24, 2011 (76 FR 52966). The notice and supporting documents were mailed to agencies and private organizations with interest in the proposed action. Publication of the notice initiated a 30-day comment period.

The Service received two comment letters in response to the notice for the proposed action during the public comment period. One letter from non-profit environmental organization and one from a private citizen, all substantive comments related to the HCP or EA have been summarized by commenter and presented in Table 8 below:

Table 8. Service responses to Kawailoa Wind Power Draft HCP/Draft EA comments.

#	Comment	Submitted By	Response
1	ABC commented that basic research as mitigation for take of Pueo (Hawaiian short-eared owl) was not sufficient. Research does not result in direct recovery, stabilization of populations, or compensatory mitigation for mortality of owls. ABC suggests instead that the mitigation emphasize concrete measures that improve habitat or species population at the site, at closely adjacent areas, or other areas agreed to by the parties. If the parties believe research is necessary to determine the concrete measures will best compensate for owl take, research should be followed by implementation of	American Bird Conservancy	Mitigation for the Hawaiian short-eared owl also includes funding management measures to aid in the recovery of the species on Oahu. This is in addition to the research that will be funded. We anticipate that the research will inform us as to the appropriate management actions to take whereupon the management measures will be implemented. Management measures for the Hawaiian short-eared owl are included for both mitigation Tiers in Section 7.5.1.2 and Section 7.5.2. Kawailoa Wind Power has made extensive revisions to their funding allocated to mortality monitoring based on feedback, and the changes have been reflected in the Funding Matrix (Appendix 8) and HCP (Section 8.2.1). The Service is satisfied that the new

	future identified measures. It is critical that post-construction monitoring be intensive and accurate in detecting mortality, not relying on mainland models and extrapolations. ABC is concerned that there does not appear to be enough funding allocated to mortality monitoring. Since mitigation levels are directly tied to take levels it is crucial that mortality monitoring be adequately funded.		amounts are sufficient and thank you for your feedback.
2	Comment is related to the proposed mitigation for seabirds. The mitigation alternatives offered for the State-endangered pueo include funding for rehabilitation of injured birds, and it was suggested such an option be added to the proposed mitigation for seabirds. Sea Life Park has operated a seabird rehabilitation center on Oahu for many years and cares for hundreds of injured seabirds every year. In 2010, concerned Hawaii residents and officials brought more than 1,000 wedge-tailed shearwaters alone to Sea Life Park. Over the past 20 years, more than 60 Newell's shearwaters have been treated at the facility, as well as 10 endangered Hawaiian petrels. This privately owned facility receives little financial benefit from seabird rehabilitation, but continues to provide this worthy service year after year, operating with a minimal budget. The commenter fully supports protecting Newell's shearwater colonies on Kauai or Maui, and states it seems reasonable to ask that Kawailoa	Barbara Maxfield	The mitigation for Newell's shearwater by Kawailoa Wind Power is directed at developing a self-resetting cat-trap which when available, will be of substantial benefit to protecting Newell's shearwaters nesting at their colonies. Mammalian predation is a major factor in the decline of Newell's shearwater throughout the Hawaiian islands. This mitigation effort is considered sufficient for Kawailoa Wind Power to offset their requested Tier 1 take. Mitigation that directly addresses threats to the endangered wildlife (such as predation), when available, is preferred by the Service over other measures such as rehabilitation which do not address the actual cause of the problem. However, given the large numbers of wedge-tailed shearwaters that are rehabilitated by Sea Life Park each year, in addition to the endangered birds that are also received, we thank you for bringing this need to our attention. We will consider funding seabird rehabilitation as an option when addressing seabird conservation needs in the future.

	Wind Power LLC additionally make some contribution toward rehabilitation of injured seabirds. A small contribution toward improved facilities at the seabird rehabilitation center would be of significant benefit both to the seabirds and the dedicated staff and volunteers who care for these birds.		

IV. Incidental Take Permit Criteria – Analysis and Findings

Section 10(a)(2)(A) of the Act specifically mandates that

> "no permit may be issued by the Secretary authorizing any taking referred to in paragraph (1)(B) unless the Permittee therefore submits to the Secretary a conservation plan that specifies—(i) the impact which will likely result from such taking; (ii) what steps the Permittee will take to minimize and mitigate such impacts, and the funding that will be available to implement such steps; (iii) what alternative actions to such taking the Permittee considered and the reasons why such alternatives are not being utilized; and (iv) such other measures as the Secretary may requires as being necessary or appropriate for the purposes of the plan."

16 U.S.C. § 1539(a)(2)(A). Section 10(a)(2)(B) of the Act mandates that the Secretary shall issue a permit if he finds

> "..after opportunity for public comment, with respect to a permit application and the related conservation plan that – (i) the taking will be incidental; (ii) the Permittee will, to the maximum extent practicable, minimize and mitigate the impacts of such taking; (iii) the Permittee will assure that adequate funding for the plan will be provided; (iv) the taking will not appreciably reduce the likelihood of survival and recovery of species in the wild; and (v) the measures, if any, required under subparagraph (A)(iv) will be met; and he has received such other assurances as he may require that the plan will be implemented…"

16 U.S.C. § 1539(a)(2)(B).

With regard to the proposed Kawailoa Wind Power HCP and ITP, the Service makes the following findings:

1. The taking of federally listed species will be incidental.

The take of covered species within the HCP covered area will be incidental to the otherwise lawful construction and operation of a 70-megawatt (MW) wind energy generation facility.

2. The Permittee will, to the maximum extent practicable, minimize and mitigate the impacts of taking federally listed species.

The Service finds that implementation of the Kawailoa Wind Power HCP is likely to adequately minimize and mitigate the impacts of take of the covered species caused by the construction and operation of the wind energy generation facility to the maximum extent practicable.

The Service applauds Kawailoa Wind Power for incorporating the recommendations of the Service Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines (Service 2004) into the HCP. Under the provisions of the HCP, Kawailoa Wind Power sufficiently reduces the risk of take because of: (1) facility design; (2) facility location; (3) facility operation; (4) placement and design of lines; (5) marking guy wires and towers; (6) restrictions on construction activities; (7) lighting plans; (8) pre-construction surveys; (9) revegetation plans; (10) wildlife monitoring; and (11) enforcement of on-site vehicular speed limits. These avoidance and minimization measures are discussed in detail in the HCP and the Service's Biological Opinion on the proposed permit action, both of which are incorporated herein by reference.

Kawailoa Wind Power proposes to offset project-related impacts and provide a net conservation benefit to the covered species through implementation of the mitigation measures. These mitigation measures were selected in collaboration with biologists from the Service, DLNR-DOFAW, First Wind, and SWCA Environmental Consulting, and with members of the State of Hawaii's Endangered Species Recovery Committee (ESRC). The mitigation program will be adjusted to account for different rates of take by establishing three Tier levels. Tier 3 applies only to the Hawaiian hoary bat. The proposed tiered approach to mitigation was designed with adaptive management in mind because of the uncertainty and assumptions associated with models used to estimate impacts to covered species, and the ability of take monitoring to detect the rare collision events involving the covered species. Any changes from the initial Tier 1 level of mitigation would be made with the approval of the Service and DLNR-DOFAW. Similarly, an adaptive management approach is also proposed for the specific type of mitigation to be implemented for each of the covered species.

The following measures summarize the types of mitigation that Kawailoa Wind Power proposes to fund on the islands of Oahu, Maui Nui and Kauai under the HCP: (1) predator control, fencing, wetland restoration, and vegetation maintenance for the protection of Hawaiian waterbirds at Ukoa Pond on Oahu; (2) restoration of wetland and forested upland habitat at Ukoa Pond for the protection of the Hawaiian hoary bat; (3) restoration and management to include fencing, ungulate removal, and predator control of forested habitat on Oahu for Hawaiian hoary bat conservation; (4) development and testing of a self-resetting cat trap which will be utilized at a Newell's shearwater seabird colony on Kauai; (5) contribute to a restoration fund for predator control, social attraction and translocation of Newell's shearwaters to Kahoolawe or another agency approved location. As with the avoidance and minimization measures, the mitigation measures are discussed in detail in the HCP and Biological Opinion.

3. The Permittee will ensure adequate funding for implementation of the HCP and provide procedures for dealing with unforeseen circumstances.

Although the overall expenditure at the Tier 1 mitigation level (excluding contingency funds) is not expected to exceed a total of $7.3M, the budgeted amounts are estimates. Kawailoa Wind Power will provide assurances of the required conservation and mitigation measures for take mitigation, even if the actual costs are greater than anticipated. Kawailoa Wind Power is establishing a $1.5M letter of credit (LC) to provide financial assurances for the proposed mitigation projects under the HCP. This amount will ensure that all reasonably expected costs associated with the Tier 1 mitigation are guaranteed in case of shortfall, default, and change of ownership, bankruptcy or any other cause. The LC will be renewed annually at this amount for the life of the project, or until it is agreed that it can be lowered, or is no longer necessary.

The LC for the first five years will provide a guarantee for all of the Tier 1 mitigation. Tier 1 mitigation is expected to cost approximately $1.8M. Of this amount, one-time costs of approximately $369,500 will be provided to the receiving parties before the commercial operation date (COD) of the project. Since this sum will be paid within the first year of the project, they are not included in the LC, which is set at $1.5M to cover the remaining amount expected to be needed to complete Tier 1 mitigation for all covered species. The cost of "in-house" mitigation measures, including those for bat monitoring, are not included in the LC. These items are considered part of operational activities, and are therefore supplementary to the actual mitigation measures. All of the Tier 1 mitigation measures are expected to be accomplished within the first 5 years of project operations. The $1.5M LC during the remaining 15 years of the project will cover all of Tier 2 costs for the covered species in the unlikely event that all species reach Tier 2 levels of take. Tier 2 mitigation is expected to cost about $1.0 M for all species, leaving $465K for additional Tier 1 bat mitigation in the event that implementation of proposed Tier 1 measures fall short of the Tier 1 mitigation obligations at the end of the first 5 years. Additional guarantees for seabird and waterbird mitigation are not required as the seabird and waterbird mitigation measures (primarily predator control methods) proposed are already known to be effective and are expected to be more than sufficient to meet mitigation requirements at the Tier 1 level.

To adapt to the needs of the project, funding that is allocated for one year may be spent early or saved for future expenditure. For practical and commercial reasons, such reallocation of funds among years may require up to eighteen months lead time in order to meet revenue and budgeting forecast requirements. Similarly, contingency funds earmarked for habitat conservation could be directed toward implementing adaptive management strategies. However, if reallocation between species or budget years and the contingency funds are not sufficient to provide the necessary conservation, Kawailoa Wind Power will nonetheless be responsible for ensuring that the necessary conservation is provided. Funding assurances are discussed in detail in the HCP and Biological Opinion.

Pursuant to the Service's "No Surprises" regulations [50 CFR 17.22(b)(5) and 17.32(b)(5)], the HCP includes procedures to deal with unforeseen circumstances. In the event of unforeseen circumstances affecting the covered species, Kawailoa Wind Power will not be required to provide additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed upon for the species covered by the HCP without their consent and provided that proper implementation of the HCP has occurred.

4. The taking will not appreciably reduce the likelihood of the survival and recovery of the federally listed species in the wild.

Kawailoa Wind Power's permit application was reviewed by the Service pursuant to section 7 of the Act because the Service finds that meeting this ITP issuance criterion constitutes a finding of "not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of [critical] habitat of such species . . . ." Section 7(a)(2), § 1536(a)(2). The Service's Biological Opinion on this proposed permit action concluded that approval of Kawailoa Wind Power's permit application is not likely to jeopardize the continued existence of the threatened Newell's shearwater, and the endangered Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, Hawaiian duck and the Hawaiian hoary bat. This conclusion was based on the following factors:

<u>Newell's Shearwater</u>

The most recent population estimate of Newell's shearwater is approximately 20,000 birds (Pyle and Pyle 2009). Radar studies and population modeling have indicated that the population of Newell's shearwater has likely been on a decline especially on Kauai (Ainley et al. 2001, Day et al. 2003a). Contributing factors to this decline such as loss of nesting habitat, predation by introduced mammals (feral cats, rats, and feral pigs) at nesting sites, and fallout of juvenile birds associated with disorientation from urban lighting are expected to continue to impact Newell's shearwater populations (Ainley et al.1997, Mitchell et al. 2005, Hays and Conant 2007). No discrete nesting colonies are known from Oahu, and locating any small and likely scattered breeding populations, if any exist, would take considerable effort. Combined with additional threats, including high fallout potential due to heavy urbanization on Oahu, makes conservation efforts on a scale that is within the scope of this project impractical and likely ineffective in terms of contribution to recovery. For these reasons, the area affected by this HCP permit action is not likely to play a substantive role in the conservation of the Newell's shearwater.

The Tier 1 requested take is for five shearwaters over 20 years, which would result in an annual rate of take of shearwaters of 0.25 shearwaters per year, which is less than 0.002% of the current estimated Newell's shearwater population. If all five mortalities occur at once, it constitutes 0.02% of the estimated population. Given these very low percentages, take caused by the proposed project would not result in significant adverse effects to Newell's shearwater at the population level. Tier 2 requested take totals 9 shearwater over 20 years, resulting in an average annual rate of take of 0.5 shearwaters per year. This impact is less than 0.004% of the overall population. If all nine mortalities occur at once, it constitutes 0.04% of the estimated population. Given these very low percentages, take caused by the proposed project would not result in significant adverse effects to Newell's shearwater at the population level and with no known nesting colonies on Oahu effects to the population would be minimal. Even so, the effects of these impacts are expected to be temporary, but can expected to persist until the surviving member of a breeding pair is able to find a mate, or the net increase in fledglings produced achieve reproductive status (a minimum of 6 years). The overall mitigation program provided in the HCP is expected to provide a net benefit to the recovery of the species through the development of a more efficient cat trap that will protect and enhance existing colonies on Kauai, where 90 percent of known nesting occurs, through the increased survival of breeding adults, increased nesting success, increased fledging success and increased available protected habitat. Through contributing to a restoration fund for predator control, social attraction and translocation of Newell's shearwaters creates an opportunity for new, protected colonies on Kauai or within Māui Nui.

Given the low percentage of the Newell's shearwater range-wide population likely to be adversely impacted by the proposed permit action, the temporary duration of these impacts, the beneficial effects of the proposed mitigation, no significant cumulative effects (because any proposed non-Federal projects involving take of the shearwater will need a HCP permit) and the limited role the action plays in the conservation of this species on Oahu, the proposed permit action is not likely to jeopardize the continued existence of the Newell's shearwater.

Hawaiian Stilt

Oahu supports 35 to 50 percent of the statewide Hawaiian stilt population, with approximately 560 to 800 birds present on the island. The take of 18 stilts in the highest tier over 20 years is not expected to substantially impact the population on Oahu. If all 18 mortalities occur at once, it constitutes 2.3% of the estimated population on Oahu. However, the population is transitory and has been documented to travel between islands and maybe more appropriate to assess on statewide basis with a population of 1200 to 1600 which would comprise an effect of 1.1%. Given these very low percentages, take caused by the proposed project would not result in significant adverse effects to Hawaiian stilt at the population level.

Ukoa Pond is identified as a "supporting wetland" on Oahu in the Draft Revised Recovery Plan for Hawaiian Waterbirds (Service 2005). One of the downlisting criteria for the four endangered waterbird species is that 75% of the supporting wetlands are protected and managed according to the practices outlined in the recovery plan. Management of a site includes a written management plan, secure water sources, managed water levels, vegetation management, predator control, waterbird population monitoring, removal of mallard-Hawaiian duck hybrids, minimized human disturbance, and monitoring and control of avian diseases and environmental contaminants. The restoration of Ukoa Pond increases available managed wetland habitat, thereby increasing population numbers through nesting success, fledging success, and through increased protected habitat.

Under the proposed HCP, the proposed mitigation for both tiers is expected to offset the anticipated adverse impacts and contribute to the species' recovery by providing a net conservation benefit through wetland restoration and management that should enhance the carrying capacity of the HCP covered area for this species.

For the above reasons, no reduction in the likelihood of the stilt's survival or recovery is anticipated with implementation of the proposed permit action after taking into account cumulative effects. Thus, the proposed project is not likely to jeopardize the continued existence of the Hawaiian stilt.

<u>Hawaiian Coot</u>

Oahu supports between 500 to 1,000 coots, or up to 33 percent of the statewide population. The take of 18 coots, over 20 years is not expected to substantially impact the population on Oahu. If all 18 mortalities occur at once, it constitutes 1.89% of the estimated population on Oahu. However, the population is transitory and has been documented to travel between islands and maybe more appropriate to assess on statewide basis with a population of 1,500 to 3,000 which would comprise an effect of 0.6%. Given these very low percentages, take caused by the proposed project would not result in significant adverse effects to Hawaiian coot at the population level.

Ukoa Pond is identified as a "supporting wetland" on Oahu in the Draft Revised Recovery Plan for Hawaiian Waterbirds (Service 2005). One of the downlisting criteria for the four endangered waterbird species is that 75% of the supporting wetlands are protected and managed according to the practices outlined in the recovery plan. Management of a site includes a written management plan, secure water sources, managed water levels, vegetation management, predator control, waterbird population monitoring, removal of mallard-Hawaiian duck hybrids, minimized human disturbance, and monitoring and control of avian diseases and environmental contaminants. The restoration of Ukoa Pond increases available managed wetland habitat, thereby increasing population numbers through nesting success, fledging success, and through increased protected habitat.

Under the proposed HCP, the proposed mitigation for both tiers is expected to offset the anticipated impacts and contribute to the species' recovery by providing a net conservation benefit through wetland restoration and management that should enhance the carrying capacity of the action area for this species.

For the above reasons, no reduction in the likelihood of the coot's survival or recovery is anticipated with implementation of the proposed action after taking into account cumulative effects. Thus, the proposed project is not likely to jeopardize the continued existence of the Hawaiian coot.

Hawaiian Moorhen

Biannual waterbird surveys record an average of 341 moorhens throughout the state (Service 2005). This average is likely an inaccurate estimate of true population size as common moorhens are secretive and difficult to census (Service 2005). The take of 18 moorhen caused by the proposed action, over 20 years is not expected to substantially impact the population on Oahu. If all 18 mortalities occur at once, it constitutes 5.3% of the estimated population on Oahu. Based on data collected by Desrochers (2008) because of ineffective survey methods for detecting this secretive bird the population is larger, and it is unlikely that this action would result in this level of take at a single period in time, take caused by the proposed project over 20-years would not result in significant adverse effects to Hawaiian moorhen at the population level.

Ukoa Pond is identified as a "supporting wetland" on Oahu in the Draft Revised Recovery Plan for Hawaiian Waterbirds (Service 2005). One of the downlisting criteria for the four endangered waterbird species is that 75% of the supporting wetlands are protected and managed according to the practices outlined in the recovery plan. Management of a site includes a written management plan, secure water sources, managed water levels, vegetation management, predator control, waterbird population monitoring, removal of mallard-Hawaiian duck hybrids, minimized human disturbance, and monitoring and control of avian diseases and environmental contaminants. The restoration of Ukoa Pond increases available managed wetland habitat, thereby increasing population numbers through nesting success, fledging success, and through increased protected habitat.

Levels of take caused by the proposed action are likely to adversely impact the moorhen in the short-term due to its small population size; however, these impacts are expected to be temporary because management can result in moorhen breeding same year replacement by fledglings and offset by increased nesting success in the action area as a result of predator control actions implemented under the HCP's mitigation program. The capture of 50 Hawaiian moorhen during predator control activities are not likely to result in harm and the action of removing predators will be beneficial to the local population. The proposed mitigation for tiers is expected to offset the anticipated impacts and contribute to the species' recovery by providing a net conservation benefit through wetland restoration and management that should enhance the carrying capacity of the action area for this species because they will be implemented at scales that adequately consider the life history requirements of the species.

For the above reasons, no reduction in the likelihood of the moorhen's survival or recovery is anticipated with implementation of the proposed action after taking into account cumulative effects. Thus, the proposed project is not likely to jeopardize the continued existence of the Hawaiian moorhen.

Hawaiian Duck

An estimated 300 hybrid Hawaiian ducks are present on Oahu (Engilis et al. 2002, Service 2005). Because it is anticipated that all hybrid Hawaiian ducks on Oahu will ultimately be removed or relocated to allow for the reintroduction of pure Hawaiian ducks, the control of hybrids at Ukoa Pond under the HCP will support the conservation role of the action area for the Hawaiian duck by contributing to the control of hybridization, the major threat to this species' recovery. In addition, restoring wetlands within the action area under the proposed HCP at a scale that adequately considers the life history requirements of this species is also beneficial to the recovery of the Hawaiian duck at the time of its re-introduction to Oahu because an increase in breeding habitat is one of its conservation needs.

For the above reasons, the proposed permit action is very compatible with the conservation needs of the species and the conservation role of the action area. Therefore, the proposed action is not likely to jeopardize the continued existence of the Hawaiian duck.

Hawaiian Hoary Bat

No reliable population estimate exists for the Hawaiian hoary bat. However, the bat is currently known on Kauai, Oahu, Molokai, Maui, and potentially widely distributed on Hawaii Island. The level of occupancy, distribution, and abundance of the bat on Oahu is also unknown. On-site surveys conducted over the 20-year project duration will provide information likely to benefit bat recovery. The proposed mitigation will likely increase the amount of available roosting habitat and foraging opportunities on Oahu and research will be guided to prove efficacy. The applicant has committed under the HCP to follow research results and fully mitigate for take even if it exceeds the permit term. The goal of the bat habitat restoration, both wetland restoration and forest enhancement, is to increase available roosting habitat and foraging opportunities which will contribute to increased adult and juvenile survival and increased productivity. Due to the small amount of information currently available about the basic biology of the Hawaiian hoary bat, the exact metric or combination thereof, to be used to determine the effectiveness of the mitigation through increased survival, will be an integral part of bat research and future conservation.

For the above reasons, no reduction in the likelihood of the species' survival or recovery is anticipated with implementation of the proposed action. Thus, the proposed project, taking into account cumulative effects, is not likely to jeopardize the continued existence of the Hawaiian hoary bat.

Based on the proposed minimization, mitigation, and adaptive measures to offset take, and the anticipated overall net conservation benefit to each covered species, it is the Service's biological opinion that the effects of permit issuance for the proposed wind energy generation facility is not likely to jeopardize the continued existence of the covered species.

5. Other measures, required by the Director of the Service as necessary or appropriate for purposes of the HCP, will be met.

The Kawailoa Wind Power HCP incorporates all other elements determined by the Service to be necessary for approval of the HCP and issuance of the Permit.

6. The Service has received the necessary assurances that the HCP will be implemented.

Kawailoa Wind Power has provided a financial analysis, certified by an independent qualified financial professional, demonstrating that the project will be capable of paying for the estimated costs of HCP obligations, including minimization, monitoring, and mitigation measures, as an ongoing operating expense paid for out of the anticipated revenue stream generated from power sales.

V. General Criteria and Disqualifying Factors

The Service has no evidence that the permit application should be denied on the basis of the criteria and conditions set forth in 50 CFR 13.21(b)-(c).

VI. Recommendations on Permit Issuance

Based on the foregoing findings with respect to the proposed action, I recommend approval of the issuance of permit number TE58126A-0 to Kawailoa Wind Power for the incidental taking of the covered species in accordance with the Kawailoa Wind Power HCP to the extent that their take will be a violation of the Act.

December 8, 2011
Date

[signature]
Deputy Regional Director
RICHARD R. HANNAN

VII. References Cited

Ainley, D.G., R. Podolsky, L. DeForest, G. Spencer, and N. Nur. 2001. The status and population trends of the Newell's shearwater on Kauai: insights from modeling. Studies in Avian Biology No. 22: 108-123.

Ainley, D.G., T.C. Telfer, and M.H. Reynolds. 1997. Townsend's and Newell's shearwater *Puffinus auricularis*. *In* The Birds of North America, No. 297, A. Poole and F. Gill, *eds*. The Birds of North America, Inc., Philadelphia, PA.

Anderson, S.K. 2002. "*Lasiurus cinereus*" (On-line), Animal Diversity Web. Available online at http://animaldiversity.ummz.umich.edu/site/accounts/information/Lasiurus_cinereus.html

Arnett, E.B., M.M.P. Huso, J.P. Hayes, and M. Schirmacher. 2010. Effectiveness of changing wind turbine cut-in speed to reduce bat fatalities at wind facilities. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

Baerwald E.F., and R.M.R Barclay. 2009. Geographic variation in activity and fatality of migratory bats at wind energy facilities. *Journal of Mammalogy* 90:1341–1349

Bannor, B.K. and E. Kiviat. 2002. Common Moorhen (*Gallinula chloropus),* The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/685 doi:10.2173/bna.685

Bonaccorso, F. 2009. U. S. Geological Survey-Biological Resources Discipline. Description of the mechanism leading to Hawaiian hoary bats getting entangled on barbed wire.

Brisbin, I. L., H. D. Pratt, and T. B. Mowbray. 2002. American Coot (*Fulica americana*) and Hawaiian Coot (*Fulica alai*). *In* The Birds of Northa America, No. 697 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Browne, R.A., C.R. Griffin, P.R. Chang, M. Hubley, and A.E. Martin. 1993. Genetic divergence among populations of the Hawaiian Duck, Laysan Duck, and Mallard. The Auk 110:49–56.

Burgett, J. 2009. U. S. Fish and Wildlife Service. Bat mortality on barbed wire fences in Hawaii.

CH2M Hill. 2011. Final Environmental Impact Statement Preparation Notice, Kawailoa Wind Farm Project, Oahu, Hawaii. Prepared for First Wind, LLC.

Day, R.H., B.A. Cooper, and R.J. Blaha. 2003a. Movement patterns of Hawaiian petrels and Newell's shearwaters on the Island of Hawai'i. Pacific Science 57: 147-159.

Day, R. H., B. Cooper, and T. C. Telfer. 2003b. Decline of Townsend's (Newell's) shearwaters (*Puffinus auricularis newelli*) on Kauai, Hawaii. The Auk 120: 669-679.

DesRochers, D. 2010. Distribution and Ecology of the Hawaiian Moorhen. Dissertation Doctor of Philosophy in Biology Tufts University, Massachusetts. May 2010.

DesRochers, D., Hugo K. W. Gee, and J. Michael Reed. 2008. Response of Hawaiian Moorhens to broadcast of conspecific calls and a comparison with other survey methods. Journal of Field Ornithology 79(4):448–457.

Dibben-Young, Arleone. 2010. Thirty Years of Banding Hawaiian Coot and Hawaiian Moorhen, 1977 – 2008. Elepaio Volume 70, Number 8 November 2010.

Engilis, Jr., Andrew, Kimberly J. Uyehara and Jon G. Giffin. 2002. Hawaiian Duck (*Anas wyvilliana*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/694

Erickson, W.P. 2003. Updated Information Regarding Bird and Bat Mortality and Risk at New Generation Wind Projects in the West and Midwest. National Wind Coordinating Committee, Wildlife Workgroup Meeting, November 18, 2003. Resolve, Inc., Washington, D.C. Available at: http://www.nationalwind.org/events/wildlife/2003-2/presentations/erickson.pdf.

Fiedler, J.K. 2004. Assessment of bat mortality and activity at Buffalo Mountain wind farm, Eastern Tennessee. Master's thesis, University of Tennessee, Knoxville.

Greisemer A. and N. Holmes 2010. Newell's shearwater population modeling for HCP and recovery planning. 51 pp.

Gruver, J.C. 2002. Assessment of Bat Community Structure and Roosting Habitat Preferences for the Hoary Bat (*Lasiurus cinereus*) Near Foote Creek Rim, Wyoming. Master's thesis, University of Wyoming, Laramie.

Hays, W.S.T., and S. Conant. 2007. Biology and Impacts of Pacific Island Invasive Species. 1. A Worldwide Review of Effects of the Small Indian Mongoose, *Herpestes javanicus* (Carnivora: Herpestidae). *Pacific Science* 61(1):3-16.

Holmes J.R. Troy, and T.W. Joyce. 2009. Status and conservation of Newell's shearwaters on Kauai, Hawaii. Reduction in breeding range and developments towards protecting colonies. Spoken paper, 36th Pacific Seabird Group Annual Meeting. Hakodate, Japan.

Iwen, F.A. 1958. Hoary bat the victim of a barbed wire fence. Journal of Mammology 39(3):438.

Jacobs, D.S. 1994. Distribution and Abundance of the Endangered Hawaiian Hoary Bat, *Lasiurus cinereus semotus*, on the Island of Hawaii. Pacific Science 48(2):193-200.

Jeffrey, J. 2007. Hakalau National Wildlife Refuge. Hawaiian hoary bat mortality per mile of fence.

Johnson, G. D. 2005. A review of bat mortality at wind-energy developments in the United States. Bat Research News 46:45–49.

Johnson, G. D, W. P. Erickson, M. D. Strickland, M. F. Shepherd, D. A. Shepherd, and S. A. Sarappo. 2003. Mortality of Bats at a Large-scale Wind Power Development at Buffalo Ridge, Minnesota. Am. Midl. Nat. 150:332–342

Kaheawa Wind Power, LLC (KWP). 2008b. Kaheawa Pastures Wind Energy Generation Facility, Habitat Conservation Plan: Year 1 Annual Report (Part II). First Wind Energy, LLC, Environmental Affairs, Newton, MA. 23 pp.

Kaheawa Wind Power, LLC (KWP). 2008c. Kaheawa Pastures Wind Energy Generation Facility, Habitat Conservation Plan: Year 2 Annual Report. First Wind Energy, LLC, Environmental Affairs, Newton, MA. 26 pp.

Kaheawa Wind Power, LLC (KWP). 2009. Kaheawa Pastures Wind Energy Generation Facility, Habitat Conservation Plan: FY09 Annual Report: Year 3 HCP Implementation. First Wind Energy, LLC, Environmental Affairs Division, Portland, ME. 23 pp.

Kaheawa Wind Power, LLC (KWP). 2010. Kaheawa Pastures Wind Energy Generation Facility, Habitat Conservation Plan: Draft FY10 Annual Report: Year 4 HCP Implementation. First Wind Energy, LLC, Environmental Affairs Division, Portland, ME. 23 pp.

Kahuku Wind Power. 2011. Kahuku Wind Power Energy Generation Facility, Habitat Conservation Plan: FY11 Annual Report: Year 1 HCP Implementation. First Wind Energy, LLC, Environmental Affairs Division, Portland, ME.

Kepler, C.B., and J.M. Scott. 1990. Notes on distribution and behavior of the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), 1964-1983. Elepaio 50(7):59-64.

Kunz , Thomas H., Edward B. Arnett, Brian M. Cooper, Wallace P. Erickson, Ronald P. Larkin, Todd Mabee, Michael L. Morrison, M. Dale Strickland, and Joseph M. Szewczak 2007. Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document. Journal of Wildlife Management 71(8): 2449–2486; 2007

Mansker, M. 2008. Natural Resource Section, U.S. Army Garrison, Hawaii. Report of dead bat on barbed wire.

Marshall, A. 2008. U. S. Fish and Wildlife Service. Report of dead bats on TNC fences at Kona Hema.

Menard, T.C. 2001. Activity patterns of the Hawaiian hoary bat (*Lasiurus cinereus semotus*) in relation to reproductive time periods. Unpublished M.S. Thesis, University of Hawaii, Honolulu.

Mitchell, C., C. Ogura, D.W. Meadows, A. Kane, L. Strommer, S. Fretz, D. Leonard, and A. McClung. 2005. Hawaii's Comprehensive Wildlife Conservation Strategy. Department of Land and Natural Resources, Honolulu, HI. Available at: http://www.state.hi.us/dlnr/DLNR/cwcs/index.html. Accessed August 21, 2008.

NatureServe. 2008. NatureServe Explorer: An Online Encyclopedia of Life. Version 7.0. NatureServe, Arlington, Virginia. Available at: http://www.natureserve.org/explorer. Accessed December 24, 2008.

NESH Working Group 2005. DRAFT Newell's Shearwater Five-year Workplan. Available at: http://state.hi.us/dlnr/DLNR/fbrp/docs/NESH_5yrPlan_Sept2005.pdf.

Nicholson, C.P., R.D. Tankersley Jr., J.K. Fielder, and N.S. Nicholson. 2005. Assessment and prediction of bird and bat mortality at wind energy facilities in the Southeastern United States: Final Report, 2005. Prepared for Tennessee Valley Authority.

Polhemus, J.T., and D.G. Smith. 2005. Update on Nesting Activity and Habitat Utilization by Native Waterbirds at the Hamakua Marsh State Wildlife Sanctuary, Kailua, Oahu. Elepaio 65(3):17-21

Pyle, R.L. and P. Pyle. 2009. The Birds of the Hawaiian Islands: Occurrence, History, Distribution, and Status. B.P. Bishop Museum, Honolulu, HI, U.S.A. Version 1 (31 December 2009) http://hbs.bishopmuseum.org/birds/rlp-monograph

Robinson, J. A., J. M. Reed, J. P. Skorupa, and L. W. Oring. 1999. Black-necked stilt (*Himantopus mexicanus*). In The Birds of North America, No. 449 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA. 32 pp.

Simons, T.R., and C.N. Hodges. 1998. Dark-rumped Petrel (*Pterodroma phaeopygia*). In *The Birds of North America*, No. 345, edited by A. Poole and F. Gill. The Birds of North America, Inc., Philadelphia, PA.

Smith D.G., and J.T. Polhemus. 2003. Habitat Use and Nesting Activity by the Hawaiian Stilt (*Himanotopus mexicanus knudseni*) and Hawaiian Moorhen (*Gallinula chloropus sandvicensis*) at the Hamakua Marsh State Wildlife Sanctuary, Kailua, Oahu. *'Elepaio* 63(8):59-62.

Spear, L.B., D.G. Ainley, N. Nur, and S.N.G. Howell. 1995. Population size and factors affecting at-sea distributions of four endangered procellariids in the tropical Pacific. Condor 97:613-638.

SWCA Environmental Consultants. 2011a. Draft Kawailoa Wind Habitat Conservation Plan. Prepared for First Wind.

SWCA Environmental Consultants. 2011b. Draft Kawailoa Wind Environmental Assessment for Habitat Conservation Plan. Prepared for U.S. Fish and Wildlife Service.

Tomich, P.Q. 1986. Hawaiian hoary bat (Lasiurus cinereus semotus). Endangered species information system, species workbook. Part I: Species distribution. Part II: Species biology. Unpublished report prepared for U.S. Fish and Wildlife Service, Washington, DC.

U.S. Fish and Wildlife Service. 2011. Service's Biological Opinion for Kawailoa Wind Power HCP Permit Issuance (Service File Number 2011-F-0415).

U.S. Fish and Wildlife Service. 2005. Draft Revised Recovery Plan for Hawaiian Waterbirds, Second Draft of Second Revision. U.S. Fish and Wildlife Service, Portland, Oregon. 155 pp.

U.S. Fish and Wildlife Service. 2004. Interim Voluntary Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines. Available at: http://www.fws.gov/habitatconservation/wind.html. Accessed March 20, 2009.

U.S. Fish and Wildlife Service. 1998. Recovery plan for the Hawaiian hoary bat (Lasiurus cinereus semotus). Portland, Oregon 50.

U.S. Fish and Wildlife Service. 1983. Hawaiian dark-rumped Petrel and Newell's manx shearwater recovery plan. Portland, Oregon. 57 pp.

U.S. Fish and Wildlife Service. 1970. Conservation of Endangered Species and other Fish or Wildlife: United States List of Endangered Native Fish and Wildlife. Federal Register 35(199)16047-16048.

Uyehara, K.J., A. Engilis, Jr., and M. Reynolds. 2007. Hawaiian Duck's Future Threatened by Feral Mallards. U.S. Geological Survey Fact Sheet 2007-3047. Available at: http://pubs.usgs.gov/fs/2007/3047/. Accessed June 20, 2008.

Wisely, A.N. 1978. Bat dies on barbed wire fence. Blue Jay 36:53.

Wright, S. E. 2008. Some significant wildlife strikes to civil aircraft in the United States, January 1990–June 2008. FAA Wildlife Strike Database, U.S. Department of Agriculture, Wildlife Services, Sandusky, Ohio, USA.