United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
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Honolulu, Hawaii 96850

In Reply Refer To:
2011-F-0415

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Memorandum

To: Chief, Division of Consultation and Conservation Planning
Pacific Regional Office
Portland, Oregon

From: Field Supervisor, Pacific Island Fish and Wildlife Office
Honolulu, Hawaii

Subject: Kawailoa Wind Power Facility on Oahu, Hawaii

This document represents the Fish and Wildlife Service's (Service) biological opinion (Opinion) regarding the Service's proposed issuance of an Endangered Species Act (ESA) section 10(a)(1)(B) permit for the Kawailoa Wind Power Facility Habitat Conservation Plan (HCP) on the island of Oahu, Hawaii. At issue are the effects of construction and operation of a 30-turbine wind energy generation facility (or wind farm) and implementation of the HCP by Kawailoa Wind Power LLC (Kawailoa Wind Power or the "Applicant"), a fully owned subsidiary of First Wind LLC, on 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*), Hawaiian duck (*Anas wyvilliana*), and the Hawaiian hoary bat (*Lasiurus cinereus semotus*); hereafter, these species will be collectively referred to as the "Covered Species." The proposed permit would authorize incidental take of the Covered Species associated with construction and operation of the Kawailoa Wind Power Facility for up to 20 years. This Opinion was prepared in accordance with section 7 of the ESA of 1973, as amended (16 USC 1531 et seq.).

This Opinion is based on the following information: (1) the Final HCP (SWCA et al. 2011); (2) the Final Environmental Assessment for the Service's proposed issuance of an ESA section 10(a)(1)(B) Permit for the HCP (Service 2011); (3) the Hawaiian Dark-rumped Petrel and Newell's Manx Shearwater Recovery Plan (Service 1983; Recovery Plan); (4) the Draft Revised Recovery Plan for Hawaiian Waterbirds, Second Draft of Second Revision (Service 2005); (5) the Recovery Plan for the Hawaiian Hoary Bat (Service 1998); (6) other biological literature cited herein; and (7) other information in our files. A complete administrative record of this consultation is on file at the Service's Pacific Islands Fish and Wildlife Office in Honolulu, Hawaii.

TAKE PRIDE IN AMERICA

CONSULTATION HISTORY

On October 24, 2011, the Service's Pacific Regional Office submitted a formal request for consultation on the proposed permit action to the Pacific Islands FWO.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Activities Covered under the Proposed Permit and HCP

The Applicant proposes to construct and operate a new 70-megawatt (MW), 30-turbine commercial wind energy generation facility at Kawailoa in the northern portion of the Island of Oahu, Hawaii (Figure 1). 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 for agriculture. Kawailoa Wind Power will supply wind-generated electricity to the Hawaiian Electric Company (HECO). Figure 1 shows the layout of the various project components, within a series of corridors that cumulatively represent the maximum project footprint. The footprint was developed based on the distribution of wind resources and other site constraints such as topography and military flight lines.

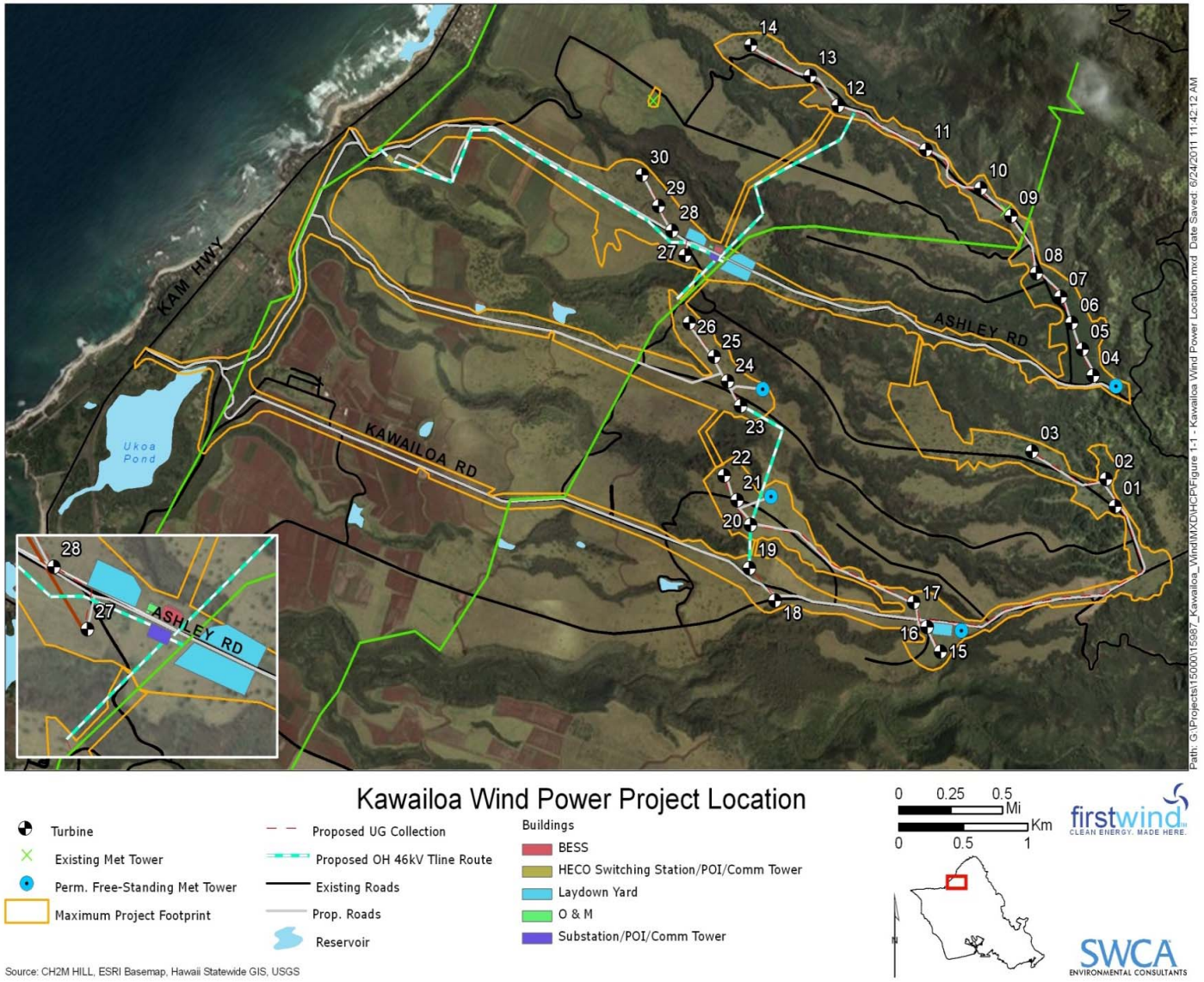

Figure 1. Kawailoa Wind Power Location and Site Layout.

Kawailoa Wind Power will consist of:

- 30 wind turbine generators (WTGs)
- 4.0 mi of overhead and 7.2 mi of underground collector lines
- one electrical substation
- an operations and maintenance building
- a lay-down area (3 locations totaling 13 acres (See Table 1)) 0.5 acres of lay-down area will be turned into parking area for operation and maintenance building, water tank storage, and a septic system
- a possible battery energy storage system (BESS)
- two communication towers
- two, point-of-interconnection (POI) facilities
- up to two permanent unguyed meteorological (met) towers. Up to four temporary guyed met towers will be also be erected for varying lengths of time prior to and during construction to gather meteorological data and for power-curve testing
- improvements to 8.2 mi of existing roads, and an addition of 4.3 mi of unpaved access roadways to connect the new WTGs to other project components
- possible installation, operation, and maintenance of up to four microwave dish antennae on two existing Hawaiian Telcom facilities near the summit of Mount Kaala

The project will have a permanent footprint of 22 acres after disturbing approximately 335 acres during construction. Approximately 259 acres of the disturbed area is likely to remain under long term vegetation management due to the maintenance of search plot areas around turbines and met towers for downed wildlife monitoring (Table 1). The maximum extent of the project footprint is illustrated in Figures 1 and 2, and includes the wind farm location and off-site communication locations.

Together with the Hawaii Department of Fish and Wildlife (DOFAW) and the Service, Kawailoa Wind Power determined that construction and operation of the wind farm has the potential to cause incidental take of six Federally listed threatened or endangered species: the Hawaiian stilt, Hawaiian coot, Hawaiian duck, Hawaiian moorhen, Newell's shearwater, and the Hawaiian hoary bat. These six Federally-listed species are known to, or may have potential to, fly in the vicinity of the project area and could be injured or killed if they collide with WTGs or other project components. Adjusted take estimates at Kawailoa Wind Power for all listed species consider both direct and indirect take. Direct take comprises individuals that are killed or injured colliding with WTGs, the permanent unguyed met towers, construction vehicles or equipment, or other project components. Indirect take accounts for the fact that listed adults that are killed or injured by project components could be in the process of tending to eggs, nestlings or dependent young. Thus, the loss of these adults would also lead to the loss of eggs or dependent young, which would be attributable to the proposed project.

The Applicant is seeking an Incidental Take Permit (ITP) in accordance with section 10 (a)(1)(B) of the ESA, and an Incidental Take License (ITL) in accordance with Chapter 195-D of Hawaii Revised Statutes. These permits are issued by the Service and the Hawaii Department of Land and Natural Resources (DLNR), respectively. The requested take authorization for Kawailoa Wind Power is tiered to accommodate a range of take levels and is summarized in Table 2.

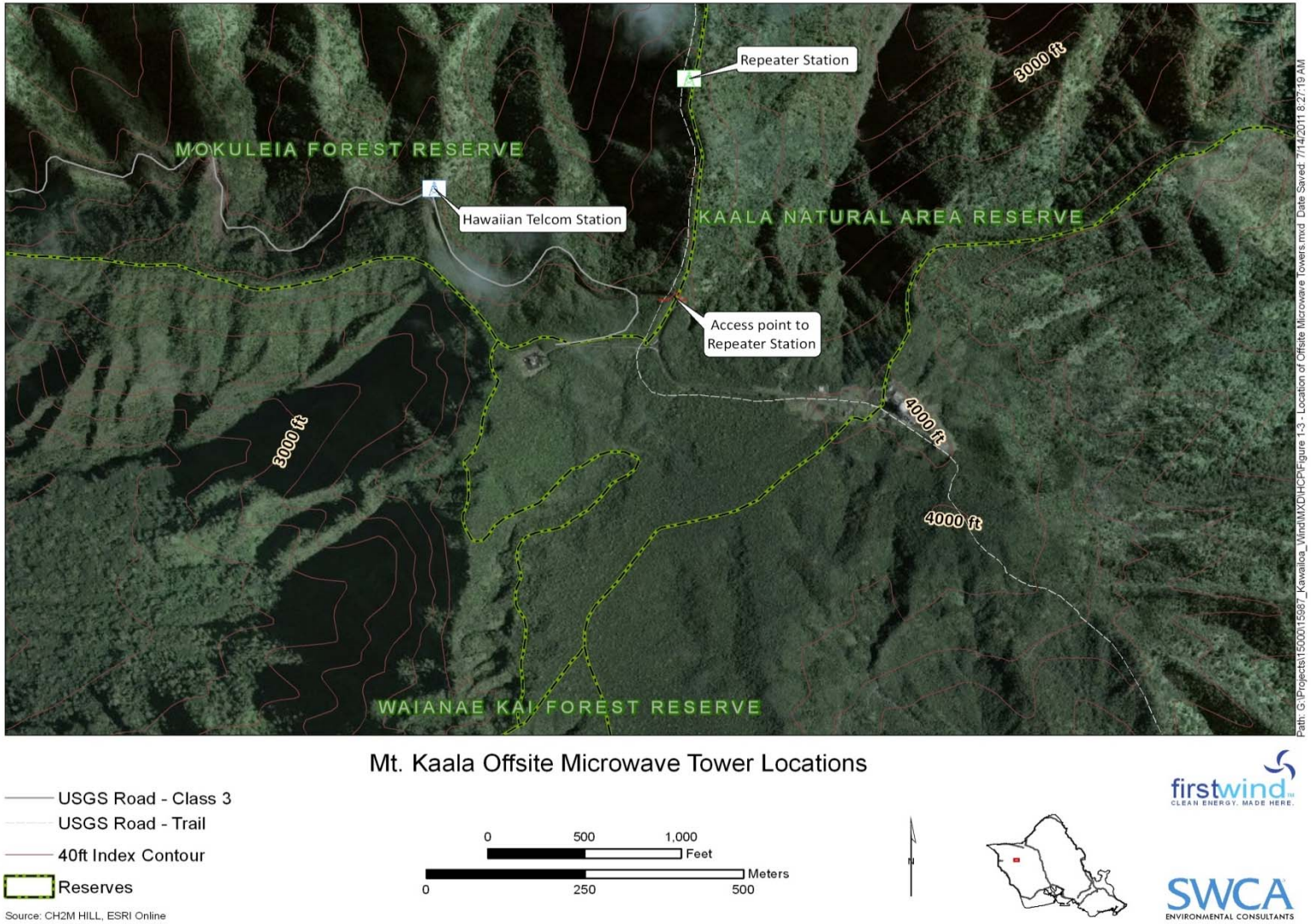

Figure 2. Location of Off-site Communication Facilities.

Table 1. Areas of disturbance associated with each project component (all areas are approximate).

Project Component	Quantity	Description of Area to be Disturbed (ft. = feet, ft^2 = square feet)	Total Extent of Disturbance	Permanent Footprint of Facilities
WIND FARM SITE				
Wind turbine generators	30 turbines	Wildlife search areas = 9.9 acres per turbine (370 foot radius) [a] Temporary work area = 2.9 acres per turbine (200 foot radius) Permanent foundation = 2,800 ft^2 per turbine (30 foot radius)	251.0 acres [a]	1.9 acres
Electrical collector lines [b]	4.0 miles of overhead lines [c] (approximately 78 poles)	Corridor width = 50 feet Footprint = 5 ft. x 5 ft. (25 ft^2) per pole	12.6 acres	0.04 acre
	7.2 miles of underground lines [d]	Corridor width = 3 feet [d]	3.2 acres	--
Electrical substation	1	200 ft. x 300 ft. = 60,000 ft^2 (1.38 acre)	1.4 acre	1.4 acre
Battery energy storage system	1	100 ft. x 250 ft. = 25,000 ft^2 (0.57 acre)	0.6 acre	0.6 acre
Interconnection facilities (each includes a control house and communication tower)	2	200 ft. x 200 ft. = 40,000 ft^2 (0.9 acre)	1.8 acres	1.8 acres
O&M building	1	70 ft. x 100 ft. = 7,000 ft^2 (0.2 acre)	0.2 acre	0.2 acre
Lay-down area	3	350 ft. x 375 ft. = 131,250 ft^2 (3.0 acres) 350 ft. x 375 ft. = 131,250 ft^2 (3.0 acres) 420 ft. x 725 ft. = 304,500 ft^2	13.0 acres	0.5 acre [e]

		(7.0 acres)		
Meteorological monitoring equipment	2 towers [f]	Wildlife search areas = 1.96 acre per tower (165 foot radius) Foundation = 35 ft. x 35 ft. (1,225 ft^2)	3.9 acre	0.1 acre
Onsite access roads	4.3 miles of existing access roads to be widened [g]	Width of straight sections = 40 ft. Width around turns ≤ 85 ft. Permanent width = 16 ft.	14.5 acres	2.1 acres
	6.8 miles of new access roads		32.9 acres	13.2 acres
Subtotal			**335.1 acres**	**21.7 acres**
MT. KAALA SITE				
Communication equipment at existing Hawaiian Telcom building	Up to 2 microwave antenna dishes	Dish mounted on existing tower (no ground disturbance, tree trimming if needed)	--	--
Communication equipment at existing Hawaiian Telcom repeater station	Up to 2 microwave antenna dishes	Dish mounted on existing tower (no ground disturbance, tree trimming if needed)	--	--
Subtotal			**0 acre**	**0 acre**
ENTIRE PROJECT				
Total			**335.1 acres**	**21.7 acres**

NOTES:

[a] Based on a radius of 370 feet for the search plot around each turbine, the total area of disturbance associated with the turbines would be approximately 296.2 acres. However, approximately 45.2 acres is considered to be unsearchable because of steep topography; therefore, the total area within the search plots is anticipated to be approximately 251.0 acres.

[b] The 46kV connector lines running from the substation to the points of interconnection (POIs) are quantified as part of this category.

[c] Of the 4.0 miles of overhead lines, approximately 1.9 miles associated with the 46kV connector lines would be located along access roads and presumably would fall within the footprint of those features. The calculation of total area disturbed by the overhead lines is based only on the remaining 2.1 miles of lines that are not located along access roads. It is possible that some of these overhead spans would instead be routed underground along access roads; the extent of disturbance associated with placing these lines underground would be equal to or less than those presented in this table.

[d] Of the 7.2 miles of underground lines, approximately 7.1 miles are along access roads, so no additional disturbance is anticipated beyond the 3-foot-wide trench. For the 0.1 mile of line that is not located along an access road, temporary disturbance is expected to occur within a 50-foot-wide corridor.

[e] The permanent footprint of the laydown areas would include the parking area for the O&M building, water tank storage, and septic system.

[f] A total of four potential meteorological monitoring tower locations have been identified; up to two permanent towers would be installed in a subset of these locations. In addition, four temporary towers would also be installed, but would be located within the work areas for the wind turbines, so there would be no additional disturbance area.

[g] The calculation of total area disturbed by the onsite access roads assumes the primary access roads leading up to the turbines (approximately 8.2 miles) would be improved, but not widened, and therefore would not have any additional area of disturbance. The existing access roads between the turbine strings would be temporarily widened up to 40 feet to allow for movement of the construction crane; these roads are assumed to have an average existing width of 12 feet. Therefore, the total area to be temporarily disturbed would be equal to the road length (4.3 miles) multiplied by an average increase in width of 28 feet (40 feet minus 12 feet). The permanent footprint would be equal to the road length (4.3 miles) multiplied by an average increase in the footprint of 4 feet (16 feet minus 12 feet)

Table 2. Requested take levels for covered species.

Covered Species	Level of Take	Requested Authorization 20-Year Limit
Newell's Shearwater	Tier 1 Tier 2	3 adults/ immatures and 2 chicks/eggs 6 adults/ immatures and 3 chicks/eggs
Hawaiian Stilt	Tier 1 Tier 2	8 adults/ immatures and 4 fledglings 12 adults/ immatures and 6 fledglings
Hawaiian Coot	Tier 1 Tier 2	8 adults/ immatures and 4 fledglings 12 adults/ immatures and 6 fledglings
Hawaiian Moorhen	Tier 1 Take by capture from trapping Tier 2 Take by capture from trapping	8 adults/ immatures and 4 fledglings 50 individuals 12 adults/ immatures and 6 fledglings 50 individuals
Hawaiian Duck	Tier 1 Tier 2	4 adults/ immatures and 4 ducklings 6 adults/ immatures and 6 ducklings
Hawaiian Hoary Bat	Tier 1 Tier 2 Tier 3	16 adults/ immatures and 8 juveniles 32 adults/ immatures and 16 juveniles 48 adults/ immatures and 24 juveniles/non-volant pups

Applicant Background

Kawailoa Wind Power LLC is a subsidiary of First Wind, a Boston-based wind energy generation firm. Kawailoa Wind Power LLC was created for the express purpose of developing a new wind generation facility at Kawailoa on Oahu. In Hawaii, First Wind operates Kaheawa Wind Power I (30 MW) on Maui, and Kahuku Wind Power (30 MW) on Oahu and is in the process of developing a HCP for Kaheawa Wind Power II on Maui.

Project History

First Wind obtained a lease from Kamehameha Schools for approximately 4,200 aces (1,700 hectares (ha)) of land within the former Kawailoa Plantation. Four temporary 60-meter (m) guy wire-supported met towers were installed on the property between August and December 2009 to collect wind resource data. One met tower was dismantled and moved to a new location in June 2010 and was then removed in September 2010. Another met tower was removed in January 2011. There are currently two temporary met towers on site. The project was granted Temporary Use Approvals by the City and County of Honolulu's Department of Planning and Permitting on August 10, 2008, September 18, 2009, and April 21, 2010. A Power Purchase

Agreement is being negotiated with HECO. An Interconnect Requirements Study with HECO is ongoing.

Project Design and Components

The Kawailoa Wind Power wind energy generation facility will consist of 30 WTGs, each with its own turbine pad (i.e., an associated work area used for component lay-down during construction, and for maintenance during operations). Each turbine site will consist of:

- a pad-mounted transformer
- a power distribution panel
- a turbine tower: The towers proposed are approximately 328 foot (ft.) (100 m) in height. The proposed rotor blade lengths are approximately 166 ft. (50.5 m). Thus, the maximum height of the turbines from tower base to highest blade tip will be 493 ft. (150.5 m).
- a gravel access drive and buffer area
- an area roughly 200 ft. (61 m) in radius surrounding each turbine site that will be temporarily disturbed during construction of the turbine components
- a poured concrete foundation area of approximately 2,800 ft^2 (260 m^2),
- a search plot area up to 9.9 acres: The search plot will extend out up to 370 ft. radius (113 m), depending on topography, and will be managed long term to maintain short stature vegetation to facilitate downed wildlife searches.

The turbines will be arranged in several arrays along the ridge tops within the project area (Figure 1).

Up to two permanent met towers will be erected during construction and remain for the duration of the project and each will consist of:

- a lattice unguyed tower 328 ft. (100 m) tall
- a search plot area up to 1.96 acres, extending out to 165 ft. radius (50 m) that will be managed long term to maintain short stature vegetation to facilitate downed wildlife searches

Other project components include: an operations and maintenance building, BESS enclosure, two interconnection facilities and one electrical substation.

The single-story operations and maintenance building will:

- be 7,000 ft^2 (650 m2) and have a maximum height of 30 ft. (8 m)
- house operation personnel, wind generating facility controls, and maintenance equipment and spare parts
- be surrounded by a temporary 1.4 acre lay-down area

The electrical substation will:

- feed electricity into an existing HECO electrical transmission line
- have a maximum footprint of approximately of 1.4 acre (60,000 ft^2)
- have free standing steel structures up to a maximum height of 50 ft.

The proposed BESS enclosure will:

- consist of an approximately 14,040 ft^2 (1,304 m^2) building roughly 25 ft. (7.6 m) high to house the components of the BESS and the HECO Control Room

The two interconnection facilities will:

- each have a control house and communication tower occupying 40,000 ft^2 (3,716 m^2)

The communications towers will:

- have up to two antennae mounted on each tower. The communications tower located at the substation (see Figure 1), will be up to 150 ft. (46 m), while the other will be approximately 50 - 60 ft. (15.3 - 18.2 m) tall.
- the remaining antennae will be installed offsite at two other existing communication towers at Mount Kaala on State conservation land currently leased by Hawaiian Telcom (Figure 2). One tower is located near the existing Hawaiian Telcom communications building, roughly 8 mi (12.9 km) from the Kawailoa project area. The second new microwave facility is located at the existing Hawaiian Tel repeater antenna on a nearby ridge. Communications equipment will be installed on existing lattice structures at both off-site locations.
- access to, as well as radar and communications activities within the Mount Kaala area are managed by the multi-agency Kaala Joint Use Coordination Committee (JUCC), which includes representatives from the U.S. Armed Services. A Conservation District Use Permit will also be required for the mounting of the antennae.

Electricity generated by the WTGs will be transformed to 23 kilovolt (kV), collected through a network of underground and overhead collection circuits and delivered to an electrical substation. At the substation, the voltage will be transformed to 46 kV and delivered to two interconnection facilities or "switchyards," both of which will be connected to existing 46 kV transmission lines which cross the site and are owned and maintained by Hawaiian Electric Company. The 50 MW switchyard will be connected to the 46 kV Waialua-Kuilima transmission line, and the 20 MW switchyard will be connected to the 46 kV Waialua-Kahuku transmission line via a new 46 kV overhead connector line. The higher-voltage 46 kV connector lines will be installed on approximately 60-foot-high poles, as specified by HECO, and will be spaced at an average interval of approximately 250 - 350 ft. (76 – 107 m).

No new transmission lines will be constructed as part of the project, only upgrading existing infrastructure (i.e. replacement of lines and undergrounding where feasible). A total of 4.0 miles (6.4 km) of overhead lines will be erected on 45-ft (13.7 m) high wooden utility poles spaced 200 – 300 ft. (61 – 91 m) apart. An additional 7.2 miles (11.6 km) of line will be underground (Table 1-1). Any underground collection cables will be buried in trenches and backfilled to finish grade. Disturbed areas will be re-vegetated following excavation and burying of cables.

DESCRIPTION OF THE HABITAT CONSERVATION PLAN

The construction and operation of the Kawailoa Wind Power wind energy generation facility could potentially adversely impact six federally listed species that are known or presumed to fly in the vicinity of the project area. These species have the potential to collide with the turbine towers, or be struck by the rotors, resulting in injury or mortality. These species also may collide

with guy wires supporting any of the temporary met towers, with the permanent unguyed met towers, with communication towers, with the overhead collection lines, or may also be harmed by the operation of vehicles or heavy equipment during construction or operations. Of the six species, five are birds: the threatened Newell's shearwater, and the endangered Hawaiian duck, Hawaiian stilt, Hawaiian coot, and the Hawaiian moorhen. The seventh species is a mammal, the endangered Hawaiian hoary bat.

Because of the documented presence of these species at or near the proposed facility and their anticipated take by construction and operation of the proposed project, the Applicant has filed an application for an ITP and an ITL. The HCP has been prepared to fulfill the application requirements for these permits. Upon issuance of the ITP and ITL, Kawailoa Wind Power LLC will be authorized for the incidental take of a limited number of individuals of these Covered Species in connection with the otherwise lawful construction and operation of the proposed Kawailoa Wind Power facility.

Scope and Term

The HCP seeks to offset the potential impacts of the proposed wind energy generation facility on the Covered Species with measures that protect and provide a net benefit to these species island wide and statewide. The Applicant anticipates a 20-year project life, throughout which the HCP would be in effect. With monitoring and review by the Service and DOFAW, the provisions for adaptive management will allow for the mitigation of project impacts to be adjusted appropriately. Accordingly, the HCP includes provisions for post-construction monitoring and adaptive management to allow flexibility and responsiveness to new information over the life of the project. All monitoring and adaptive management activities will be subject to approval by the Service and DOFAW.

Action Area and Project Footprint

The Project footprint is the development area for the proposed wind energy generation facility and associated infrastructure on Kamehameha School's property and off-site telecommunications antennas at Mount Kaala. The mitigation to offset adverse impacts to Newell's shearwater creates an action area that extends to the island of Kauai and islands of Maui Nui (Kahoolawe, Molokai, Lanai, and Maui). Restoration activities as they currently proposed will occur on Kamehameha School's property for Hawaiian waterbirds and Hawaiian hoary bats.

Avoidance and Minimization Measures

Avoidance and Minimization Measures for Project Construction

- Improving drainage in areas as needed to eliminate the accumulation of standing water after periods of heavy rain to minimize the potential of attracting waterbirds to the site.
- Refraining from clearing trees above 15 ft. in height for construction between June 1 and September 15, which is the period when non-volent Hawaiian hoary bat juveniles may occur in the project area.
- To minimize the potential for introduction of non-native invasive ant species at either of the Hawaiian Telcom sites, baseline surveys of ant fauna will be conducted before and following installation of the antennas, in coordination with DOFAW staff. In addition,

all materials and vehicles will be inspected for the presence of ants before transport to the site. If new species of ants are detected in the post-construction survey, and are attributed to the construction work, control measures will be implemented to remove the new species from the area. A post invasive species monitoring report will be submitted to Service and DOFAW one month after the six month monitoring period. Report will include survey methodology, results of surveys and success of minimization avoidance measures. Service and DOFAW will maintain final approval for successful implementation.

Avoidance and Minimization Measures for Collisions with Project Structures

- Using "monopole" steel tubular turbine towers rather than lattice towers. Tubular towers are considerably more visible than lattice towers and should reduce collision risk.
- The use of unguyed instead of guyed permanent met towers for the project site.
- Marking guy wires on temporary met towers with high visibility bird diverters made of spiraled PVC and twin 12-inch white poly vinyl marking tape to improve the visibility of the wires.
- Utilizing a rotor with a significantly slower rotational speed (range of 6 – 16 rpm) compared to older designs (28.5 – 34 rpm). This increases the visibility of turbine blades during operation and decreases collision risk.
- Placement of power collection lines underground as far as practicable to minimize the risk of collision with new wires; overhead collection lines will be fitted with marker balls to increase visibility where appropriate. All overhead collection lines will be spaced according to Avian Power Line Interaction Committee (APLIC) guidelines to prevent possible electrocution of native species. Species most at risk are those likely to perch on power poles or lines (APLIC 2006). If a vertical arrangement is chosen, a vertical spacing of more than 15 inches (38 cm, head-to foot length) will be used (APLIC 2006). Any jumper wires will be insulated.
- Overhead collection lines will be parallel to tree lines whenever possible. Overhead lines spanning the gulches will be fitted with marker balls to increase their visibility to Covered Species and minimize risk of collisions.
- Where feasible, minimizing night-time construction activities to avoid the use of lighting that could attract Newell's shearwaters, seabirds protected under Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. § 703-712), as amended (MBTA) and possibly bats.
- Use of minimal on-site lighting at buildings and using shielded fixtures that will be utilized only on infrequent occasions when workers are at the site at night. Onsite lighting will be fitted with motion-sensors, automatic shut-off timers or similar devices to limit lighting to periods when personnel are actively working.
- Implementing low wind speed 5 m/s curtailment to reduce the risk of bat take:
  Based on data collected to date, the curtailment will initially occur during months of March to November, which is when bat activity at the project site has been relatively higher. Curtailment will be for the duration of the night (from sunset to sunrise). Curtailment will also be extended if fatalities are found outside the initial proposed curtailment period with direction from Service and DOFAW.
- A speed limit of 15 mph will be observed while driving on site, to minimize collision with species listed in the HCP.

Avoidance and Minimization Measures for Wetland Restoration at Ukoa Pond

- In areas where Hawaiian waterbirds have been observed, nest searches should be conducted prior to any work being conducted and after any subsequent delay in work of three or more days (during which birds may attempt nesting).
- If a nest is discovered, work should cease in the vicinity for a minimum of seventy days (10 weeks); if a nest with chicks/ducklings is discovered, work should cease for a minimum of 49 days (7 weeks) within 150 ft. These guidelines are intended to protect chicks/ducklings, and may be shortened if monitoring is conducted often enough to note when chicks/ducklings have fledged (usually five to six weeks after hatching). Work should not begin in the area until two weeks after chicks/ducklings have fledged.
- If an endangered Hawaiian waterbird is found in the project's action area during on-going work, then all activities within 50-ft. of the bird should cease; work may continue after the bird leaves the area of its own accord.
- All ungulate fences built to implement mitigation measures for the Covered Species will have a barbless top-strand of wire to prevent entanglements of the Hawaiian hoary bat on barbed wire.

Mitigation Measures

The HCP describes how the Applicant will avoid, minimize, mitigate and monitor the incidental take of threatened and endangered species that may occur during construction and operation of the proposed project. The general and species-specific mitigation measures the Applicant is proposing are intended to increase knowledge of the species' biology and distribution, enhance populations, or restore degraded native habitat. Mitigation measures are required to provide a net benefit to the species as required under State law. Detailed description of mitigation measures is outlined in the Kawailoa Wind HCP (SWCA 2011). HCP mitigation measures are briefly summarized and presented in Table 3 for each of the Covered Species.

The 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 collision events involving the covered species. Any changes from the initial Tier 1 level of mitigation would be made only with the approval of the Service and DOFAW. Similarly, an adaptive approach is also proposed for the specific type of mitigation to be implemented for each of the covered species.

Table 3. Mitigation measures for the Covered Species

Species or Species Groups	Proposed Mitigation by Measured Take Level	
	Tier 1	**Tier 2 or Above**
Newell's Shearwater	Development and testing of cat self-resetting trap, efficacy testing and implementation at a Newell's shearwater colony on Kauai.	Contribute to a restoration fund for predator control, social attraction and translocation of Newell's shearwaters to Kahoolawe or other approved location.

Hawaiian Waterbirds	Predator control, fencing, and vegetation maintenance at Ukoa Pond or other site for five years plus MOA between First Wind and Kamehameha Schools for long term commitment to management of pond. Subsequent mitigation efforts to meet Tier 1 requested take as required.	Predator control, fencing, and vegetation maintenance at Ukoa Pond or other site for five years plus MOA between First Wind and Kamehameha Schools for long term commitment to management of pond. Additional mitigation efforts at Ukoa Pond or at additional wetlands.
Hawaiian hoary bat	Restoration of wetland or forest habitat to increase foraging capacity and provide additional roost trees. Research to evaluate the efficacy of wetland or forest mitigation.	Tier 2 and Tier 3: Additional restoration of wetland or forest habitat to increase foraging capacity and provide additional roost trees.

Newell's Shearwater Mitigation

Although providing mitigation on Oahu for most 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 contribution to this species' recovery.

Tier 1 mitigation for Kawailoa Wind Power is funding the development of a self-resetting cat trap and deployment 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 by in the Recovery Plan for the Hawaiian Petrel and Newell's Shearwater (Service 1983) and the 5-Year Work Plan for Newell's Shearwater (NESH Working Group 2005).

For Tier 2 rates of take, Kawailoa 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 Waterbird 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 resighting study will also be used to quantify productivity and mitigation success.

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. The Applicant will manage Ukoa Pond to remove hybrids. Strategies for implementing culling will be outlined in a Management Plan for Ukoa Pond that will be approved by the Service and DOFAW prior to its implementation.

Hawaiian Hoary Bat 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 wetland 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.

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.

Additionally, the HCP outlines a monitoring protocol to determine the actual take of each species after the facility begins operating. The HCP incorporates adaptive management provisions to allow for modifications to the mitigation and monitoring measures as knowledge is gained during HCP implementation.

STATUS OF THE SPECIES

Newell's Shearwater

Species Description

Newell's shearwater is a member of the genus *Puffinus* and utilizes open tropical seas and offshore waters near its island breeding grounds on forested mountain slopes. Newell's shearwater is approximately 12 to 14 inches long, with a wingspan of 30 to 35 inches, and weighs approximately 14 ounces. Its plumage is glossy black above, and white below. It has a

black bill that is sharply hooked at the tip. Its claws are well adapted for burrow excavation and climbing.

Listing Status

The Newell's shearwater was listed as an endangered species 1975 (Service 1983), pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in April 25, 1983. A species five-year review was completed September 27, 2011 pursuant to Section 4(c)(2) of the Act the review recommend uplisting to endangered due to precipitous decline in populations on Kauai over the last couple decades. Critical habitat has not been designated for the Newell's shearwater (Service 1983).

Historic and Current Distribution

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 Hawaii, on Molokai, and may still nest on Oahu. The occurrence on Maui of injured, dead, or grounded adults in the summer, low numbers of radar-detected birds exhibiting Newell's shearwater-like timing of movement, and the presence of juveniles in autumn suggest that this species also nests on Maui.

Recent ornithological radar surveys, combined with returns of downed birds to the SOS 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. 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).

Life History

Most of the life history information for this species is based on studies of the Kauai population; life histories of birds on other Hawaiian islands may differ slightly. During their nine-month breeding season from April through November, Newell's shearwaters live colonially in burrows under ferns on forested mountain slopes. These burrows are used year after year and usually by the same pair of birds. A single egg is laid in late May or early June (Ainley et al. 1997, pp. 13-15). Both sexes incubate and this period lasts approximately 45 days. Fledging occurs between October and November. The Newell's shearwater needs an open downhill flight path to become airborne.

Daily flights of breeding adults to and from the colonies occur only at night and just before dawn. On Kauai, Newell's shearwaters were found to exhibit almost no movement until after complete darkness, whereupon they moved inland in a wave that peaked for 30-40 minutes (Day and Cooper 1995, p. 1015). After that peak, the rate of movement decreased steadily until 90 min after complete darkness, after which few birds were seen. In the morning, Newell's shearwaters begin moving to sea in numbers approximately 40 minutes before the first measurable light and movement rates increase rapidly and peak just before dawn (Day and Cooper 1995, p. 1016).

Three age classes of Newell's shearwaters are recognized based on demographic factors and assumptions (from Ainley et al. 2001, p. 115): (1) young-of-year; (2) pre-breeding immature/adult (if recognizable); and (3) breeding adults. Only 46 percent of pairs that actively use a burrow actually breed in a given year on Kauai (Ainley et al. 2001, p. 117). First breeding occurs at approximately six years of age (Ainley et al. 1997, p. 17).

A study of reproductive success at one Newell's shearwater colony on Kauai documented an average annual production of 0.66 young per pair (Ainley et al. 2001, p.117). No specific data exist on the longevity for this species, but other shearwaters may reach 30 years of age or more.

Habitat Description

On Kauai, Newell's shearwaters breed at elevations between 528 and 3,960 feet. Newell's shearwaters usually nest where the terrain is vegetated by an open canopy of trees with an understory of densely matted uluhe ferns (*Dicranopteris linearis*). Some Newell's shearwaters nest in other types of habitat such as on the walls of Waimea Canyon, Kauai, where a forest canopy is absent. Burrows used by Newell's shearwaters are most commonly placed at the base of trees, where the substrate may be easier for the birds to excavate.

Threats, Conservation Needs, and Ongoing Conservation Measures

Newell's shearwater was listed as a threatened species by the Service in 1975 (Service 1975). *The Hawaiian Dark-rumped Petrel and Newell's Manx Shearwater Recovery Plan* was published in 1983 (Service 1983). During the last 150 years, 75 percent of the forests on the main islands of the Hawaiian archipelago have been converted to agricultural, military, commercial or residential land uses, leading to a depletion of available nesting habitat for this species. The introductions of the mongoose (*Herpestes auropunctatus*), black rat (*Rattus rattus*), and Norway rat (*Rattus norvegicus*) have also played a primary role in the reduction of ground-nesting seabirds. Predation by feral cats (*Felis domesticus*) and barn owls (*Tyto alba*) has been observed. In addition, feral pigs (*Sus scrofa)* are known to collapse burrows as well as consume or prey upon shearwaters.

Another major threat is the species' attraction to light. Increasing urbanization and the accompanying artificial lights have resulted in substantial problems for fledgling Newell's shearwaters during their first flight to the ocean from their nesting grounds. When attracted to man-made lights, fledglings become confused and may suffer temporary night blindness. They often fly into utility wires, poles, trees, and buildings and fall to the ground. Since 1979 the Kauai District of DOFAW has supported the SOS program to collect "downed" Newell's shearwaters and Hawaiian petrels (*i.e.*, birds that have either collided with structures or fallen

out, or have been injured or killed due to exhaustion caused by light attraction). According to SOS files, over 33,000 seabirds have been recovered to date (DOFAW 2008). The majority of the birds are Newell's shearwaters, which nest in greater numbers on Kauai than Hawaiian petrels. The lower number of Hawaiian petrels recovered is thought to be a function of their population size on Kauai, not due to differences in behavior or ability to detect structures in the dark.

The Draft Newell's Shearwater and Hawaiian Petrel Five-year Action Plan describes a recovery strategy that will 1) protect and enhance existing colonies, 2) create new colonies, 3) mitigate new and existing threats by a) implementing prioritized management actions, and b) undertaking research and outreach to support those actions. Actions identified to accomplish this strategy include conducting surveys for existing colonies, controlling threats at the highest priority colonies, and minimizing and monitoring terrestrial threats (light attraction, power line collisions).

The DLNR has been conducting auditory surveys for new areas containing nesting Newell's shearwater through their Kauai Endangered Species Recovery Program (KESRP) and is developing colony ranking criteria to identify where the goals of the action plan can be most successful. The minimum conditions necessary to effectively implement colony management that would be expected to achieve a measureable increase in seabird survival and/or reproduction include species presence, access to the areas occupied by breeding seabirds, and landowner authorization and commitment to maintain the managed area in way that is consistent with seabird conservation. To date, only two known nesting colonies occupied by Newell's shearwater (Hono o Na Pali Natural Area Reserve (NAR) and Upper Limahuli Valley) are currently suitable for immediate implementation of management actions focused on increasing seabird survival and reproduction. The State has developed a management plan for the Hono o Na Pali NAR that includes feral ungulate control, but little progress has been made due to the lack of funding. A 400-acre portion of the privately-owned Upper Limahuli Preserve has been fenced to create an ungulate free area known to contain nesting Newell's shearwaters. Feral cat control is being funded through the KIUC short-term HCP for the next four to five years.

While some efforts to protect existing nesting colonies of Newell's shearwater have been implemented on Kauai, they have been limited to constructing ungulate fencing around remaining areas of relatively intact habitat (Wainiha Valley, Upper Limahuli Valley, etc.). Habitat degradation due to feral ungulates is recognized as the primary threat to native ecosystems in Hawaii and the conservation and restoration of such areas is unsuccessful in the presence of ungulates (Hawaii Conservation Alliance 2005, p. 1). The only active control of cats and/or rats within an area occupied by nesting Newell's shearwaters on Kauai (on private property in Upper Limahuli Valley) began in 2009. Funding for the program is currently through the KIUC short-term HCP for up to the next five years. Long-term funding is anticipated to be obtained through an Island-wide HCP currently under development.

Efforts to reduce the level of light attraction and power line collisions began in the 1980's when Kauai Island Utility Cooperative (KIUC, and its predecessor Kauai Electric) began replacing unshielded street lights with full-cutoff (shielded) lights across the island as part of its normal maintenance program. All of the over 3,500 streetlights operated by KIUC are now shielded, as are the lights at the facilities it operates. In 2002 KIUC prepared an assessment of the power line segments originally identified by Ainley et al. (1995) as causing the most collisions (David and

Day 2002). In 2007, KIUC began reconfiguring the lines along one of the "hotspot" areas along Kealia Beach by temporarily changing the uppermost electrical circuit from a vertical to a horizontal arrangement which eliminated three of four wire layers in the circuit and reduced the height by about 10 feet. KIUC has been coordinating with the Federal Highways Administration and Hawaii Department of Transportation to plan for the undergrounding of the lines along another hotspot segment near the Wailua River but the implementation has been delayed while issues related to the potential impacts of the project to cultural resources are being resolved.

Hawaiian Stilt

Species Description

The Hawaiian stilt is a slender wading bird, black above (except for the forehead), white below, and with distinctive long, pink legs. Sexes are distinguished by the color of the back feathers (brownish female, black male) as well as by voice, which is lower in females. Downy chicks are well camouflaged, tan with black speckling. Immature birds have a brownish back and white patches on their cheeks (Hawaii Audubon Society 2005, p. 49). The total length of adult Hawaiian stilts is about 16 inches (40 centimeters) with the mass of males and females averaging 199 ± 13.8 g (n=42) and 206.2 ± 21.7 g (n=43), respectively (Robinson et al. 1999, p. 16).

Listing Status

The Hawaiian stilt was listed as an endangered species on October 13, 1970 (Service 1970), pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released on May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4(c)(2) of the Act which requires a five-year review after listing. Critical habitat has not been designated for the Hawaiian stilt (Service 2005, p. 3).

Historical and Current Distribution

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. The State of Hawaii Division of Forestry and Wildlife 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 (see Figure 3). Because Hawaiian stilts readily disperse between islands they are considered a homogenous meta-population (Service 2005, p. 28).

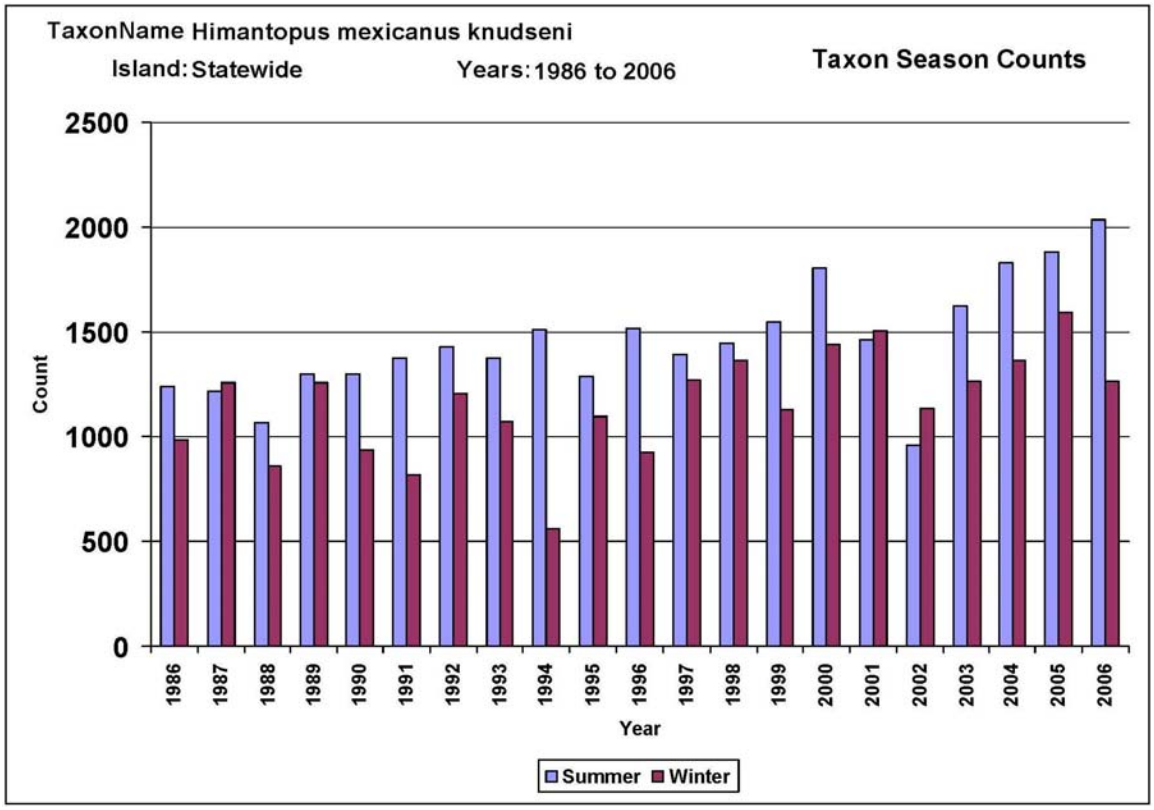

Figure 3. State Waterbird Surveys 1986 – 2006: Summer and Winter Counts of Hawaiian stilt.
Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007

Ecology

Hawaiian stilts use a variety of aquatic habitats but are limited by water depth and vegetation cover. Hawaiian stilts are known to use ephemeral lakes, anchaline ponds, prawn farm ponds, marshlands and tidal flats. Foraging habitat for Hawaiian stilts is early successional marshland or other aquatic habitat with a water depth less than 9 inches (22 centimeters) and perennial vegetation that is limited and low-growing. Native low-growing wetland plants associated with stilt nesting areas include water hyssop (*Bacopa monnieri*), sea purslane (*Sesuvium portulacastrum*), and the sedges makaloa (*Cyperus laevigatus*) and kaluha (*Bolboschoenus maritimus*) (Service 2005, p. 31). They may also use taro (*Colocasia esculenta*) ponds where the full-grown vegetation forms a protective canopy.

Stilts are opportunistic feeders. They eat a wide variety of invertebrates and other aquatic organisms available in shallow water and mudflats. Specific organisms taken include water boatmen (Corixidae), beetles (Coleoptera), possibly brine fly (*Ephydra riparia*) larvae, polychaete worms, small crabs, Mozambique tilapia (*Tilapia mossambica*), western mosquito fish (*Gambusia affinis*), and tadpoles (*Bufo* spp.) (Service 2005, p. 31).

Life History

Hawaiian stilts prefer to nest on freshly exposed mudflats interspersed with low growing vegetation (Service 2005, p. 32). Nesting has also been documented on low relief islands

(natural and man-made) in fresh or brackish ponds, man-made floating nest structures, floating wooden platforms, and cleared level areas near foraging habitats. The nest itself is a simple scrape on the ground. They have also been observed using grass stems and rocks for nesting material (Coleman 1981). Stilts defend an area of 66 to 99 feet (20 to 30 meters) around the nest and are semi-colonial.

The nesting season normally extends from mid-February through August (Robinson et al. 1999). Peak nesting varies among years and re-nesting can occur after loss of a clutch (Robinson et al. 1999). Stilts usually lay three to four eggs that are incubated for approximately 24 days (Coleman 1981; Chang 1990). Chicks are precocial, leaving the nest within 24 hours of hatching. Adults with three-day old chicks have been observed to move 0.3 miles (0.5 kilometers) from the nest site (Reed and Oring 1993). Young may remain with both parents for several months after hatching (Coleman 1981).

Threats

Threats are addressed as a combined assessment for all four species of Hawaiian waterbirds: the Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and the Hawaiian duck. We evaluate the threats on these species jointly because they share common causes of decline of their populations. The Hawaiian duck section also includes a unique threat of hybridization to that species.

The primary causes of the decline of the Hawaiian waterbirds are the loss of wetland habitat, predation by introduced animals, hunting in the late 1800s and early 1900s, disease, and environmental contaminants. A significant amount of Hawaii's wetlands have been lost due to human activities, including filling and draining for agriculture, houses, hotels, and golf courses. The Service estimates that 22,475 acres (9,095 hectares) of wetlands existed within the coastal plains of Hawaii in the 1780s. In 1990, the Service estimated that only 15,474 acres (6,262 hectares) remained, which is a decrease of 31 percent (Service 2005, p. 45).

The loss of suitable wetland habitat is compounded by the alteration of wetland plant communities due to invasion by non-native plants. Species such as California grass (*Brachiaria mutica*), pickleweed (*Batis maritima*), water hyacinth (*Eichornia crassipes*), Indian fleabane (*Pluchea indica*) and red mangrove (*Rhizophora mangle*) present a serious threat by outcompeting more desirable species and eliminating open water habitats. Unmanaged vegetation significantly reduces open water, shallow water, bare ground, and exposed mudflat habitat. All of these habitats are under serious threat without management to control these aggressive plant species (Service 2005, p. 45).

Introduced predators are considered a primary factor limiting Hawaiian waterbird populations. Small Indian mongoose (*Herpestes auropunctatus*), feral cats (*Felis catus*), and feral dogs (*Canis lupus familiaris*) are all presently found within wetlands and pose a serious threat to Hawaiian waterbird reproductive success. All three of these predatory species are known to take eggs, young birds, and even adults (Service 2005, p. 46). Both cats and dogs are of particular concern because of the close proximity of many of Hawaii's wetlands to urban areas. Other species, such as the cattle egret (*Bubulcus ibis*), American bullfrog (*Rana catesbeiana*), and rats have been observed congregating around nesting waterbirds just prior to chicks hatching (Woodside 1997, pers. comm.). Oahu National Wildlife Refuge (NWR) staff have documented predation of

waterbird chicks by the cattle egret and the black-crowned night heron (*Nycticorax nycticorax*). A bullfrog was documented preying upon a Hawaiian moorhen chick at Hanalei NWR (Viernes 1995, 55:37). More recently, the "Key Predators" study of 2003 to 2004 on James Campbell NWR provided the first multiple observations of Hawaiian stilt chick predation by bullfrogs, which accounted for 45% of chick losses over the study period (Eijzenga 2005, p. 3).

The most prevalent disease affecting Hawaiian waterbirds is avian botulism. Avian botulism is caused by a toxin produced by a widespread bacterium (*Clostridium botulinum*). Normally dormant, these spores release toxins only when certain conditions occur, including warm temperatures and stagnant waters. Birds usually acquire the disease by eating invertebrates containing the toxin. Typical signs in birds include weakness, lethargy, and inability to hold up the head or to fly (Work 2008, pers. comm.). Botulism can occur in any area with standing fresh or brackish water frequented by waterbirds. Avian botulism outbreaks are common in Hawaii and are a significant cause of waterbird mortality (Pratt and Brisbin 2002, p. 36). The first outbreak in Hawaii occurred on Oahu at Kaelepulu pond, which is also known as Enchanted Lake, in Kailua in 1952. Since then, avian botulism outbreaks have been documented at Hanalei NWR on Kauai, Aimakapa pond at Kaloko-Honokahau National Historical Park on Hawaii, Ohiapilo pond on Molokai, and at Kealia NWR on Maui (Pratt and Brisbin 2002, p. 36).

The possibility of West Nile virus or avian influenza reaching the Hawaiian Islands from the U.S. mainland or Asia is a recent concern. The impact these two diseases may have on the Hawaiian waterbirds is not known at this time, but they could have deleterious impacts if they reach the Hawaiian Islands.

Environmental contaminants in wetlands are of concern to Hawaiian waterbirds because the general diet of these birds makes them susceptible to toxins accumulated in the food chain (Ratner 2000, p. 1-2). In 1988, a fuel spill in Pearl Harbor caused direct mortality and nest abandonment of Hawaiian waterbirds at the Honouliuli unit of Pearl Harbor NWR (J. Leinecke 1993, pers. comm.). In 1996, an oil spill in Pearl Harbor imperiled the Hawaiian stilt as well as marine fisheries. Urban encroachment has the potential to negatively affect waterbirds' habitats via flushing of household and industrial products into water-collecting systems (storm drains and roadside ditches) which lead to streams, wetlands, and the ocean. Currently, little is done to survey for toxicants at wetlands.

Conservation Needs of the Species

Preventing wetland loss, managing existing wetland habitat, and predator control at primary nesting sites are necessary actions to increase Hawaiian waterbird populations. As described in the Second Draft of the Revised Recovery Plan for Hawaiian Waterbirds, recovery of the Hawaiian waterbirds focuses on the following objectives: (1) increasing population numbers to a statewide baseline level; (2) establishing multiple, viable breeding populations throughout each species' historical range; and (3) establishing a network of wetlands on the main islands that are protected and managed for waterbirds (Service 2005, p. 71-72).

Protection of a wetland implies that the wetland is secure from development. 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 (Service 2005, p. 71).

The recovery strategy for the Hawaiian waterbirds relies on a combination of protection and management of core and supporting wetlands to maintain self-sustaining breeding populations. Core wetlands are defined as areas that provide habitat essential for the larger populations of Hawaiian waterbirds that comprise the bulk of the numbers prescribed for recovery. It is crucial for wetlands in these sites to be secure from conversion to non-wetland condition and to have sufficient enduring management to recover Hawaii's waterbirds. Supporting wetlands are additional areas that may not support the bulk of waterbird populations but provide habitat important for smaller waterbird populations or that provide habitat needed seasonally by segments of the waterbird populations during part of their life cycle (Service 2005, p. 66).

Ongoing Conservation Actions

A variety of conservation measures have been implemented to protect Hawaii's endangered waterbirds. Efforts directly benefitting the Hawaiian waterbirds include a long-term hunting ban, protection of habitat through establishment and management of Federal and State refuges and sanctuaries, and predator control. Actions that inform conservation of the species include a biannual waterbird survey conducted by DOFAW since the mid-1950s, population monitoring, and research (Service 2005, p. 58-64).

Hawaiian Coot

Species Description

The Hawaiian coot was considered a subspecies of the American coot (*Fulica americana*), but is now considered a distinct species (Service 2005, p. 11). Adults have a black head, a slate gray body with white undertail feathers, and a prominent white frontal shield and bill; feet are lobed rather than webbed and are greenish-gray. No reliable measurements of total length or size are available; however, the Hawaiian coot is slightly smaller in body size than the American coot which averages 13 to 17 inches (32 to 43 centimeters) in total length and 15 to 30 ounces (427 to 848 grams) in mass (Pratt and Brisbin 2002, p. 34).

Listing Status

The Hawaiian coot was listed as an endangered species on October 13, 1970 (Service 1970), pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released on May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4(c)(2) of the Act which requires five-year review after listing. Critical habitat has not been designated for the Hawaiian coot (Service 2005, p. 3).

Historical and Current Distribution

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 1,000 and 1,500 individuals. Hawaiian coots occur in coastal plain wetlands usually below 1,320 feet (400 meters) elevation on all the main Hawaiian Islands except for Kahoolawe; however, breeding is restricted to relatively few sites. About 80 percent of the population occurs on Kauai (Hanalei, Huleia, Opaekaa), Oahu (coastal wetlands and reservoirs such as Lake Wilson and Nuuanu Reservoir, Kahuku Point and along the windward shore), and Maui (Kanaha and Kealia Ponds, Nuu Pond) (Service 2005, p. 12). The remaining 20 percent of the population occurs in coastal ponds and playa wetlands.

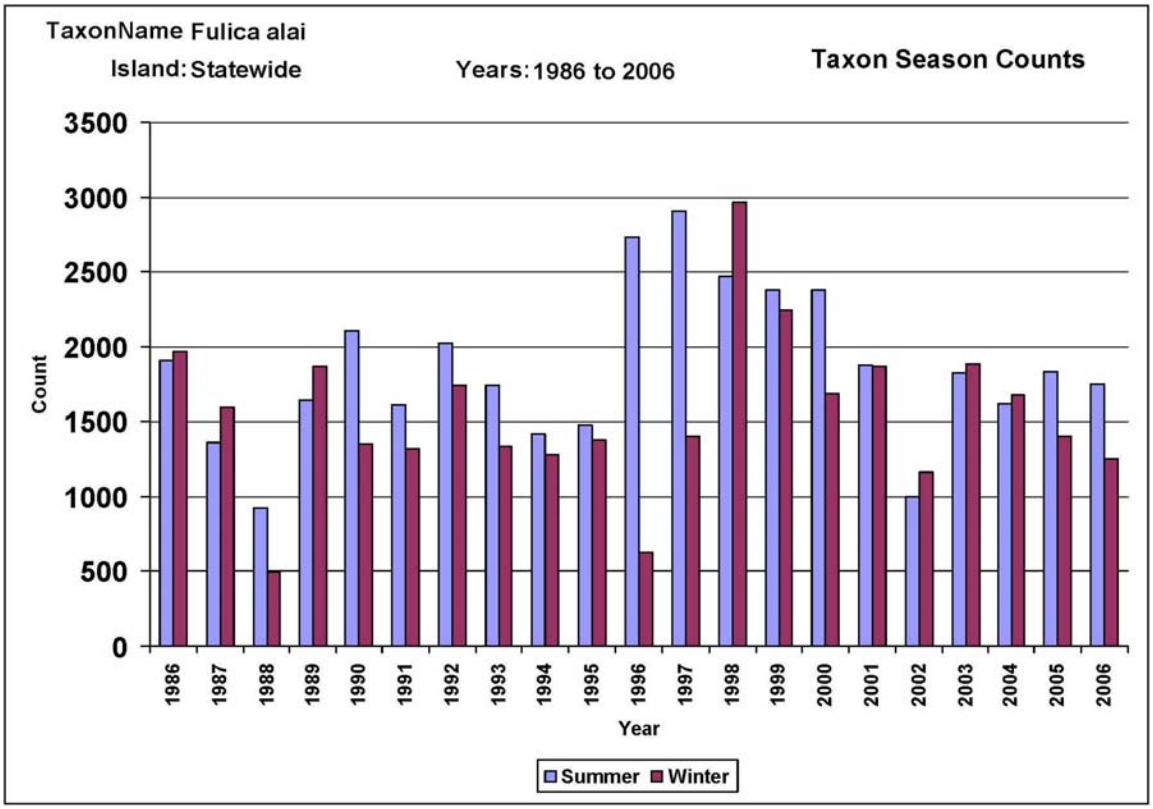

Figure 4. State Waterbird Surveys 1986 – 2006: Summer and Winter Counts of the Hawaiian coot. Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007

Ecology

The species is somewhat gregarious and uses freshwater and brackish wetlands, including agricultural areas (*e.g.*, taro fields) and aquaculture ponds. Hawaiian coots generally occur in lowland (below 1,320 feet (400 meters) elevation) wetland habitats with suitable emergent plant growth interspersed with open water, especially freshwater wetlands, but also freshwater reservoirs, cane field reservoirs, sewage treatment ponds, taro loi, brackish wetlands, and limited use of saltwater habitats. However, on Kauai, some birds occur in plunge pools above 4,900 feet (1,494 meters) elevation and on the island of Hawaii, stock ponds up to 6,600 feet (2,000 meters) elevation. The species typically forages in water less than 12 inches (30 centimeters) deep, but will dive in water up to 48 inches (122 centimeters) deep. Compared to Hawaiian moorhen, Hawaiian coots prefer to forage in more open water. Logs, rafts of vegetation, narrow dikes,

mud bars, and artificial island are utilized for resting. Ephemeral wetlands support large numbers during non-breeding season.

Hawaiian coots are generalists and feed on land, grazing on grass adjacent to wetlands, or in the water. They have been observed grazing from the surface of the water, or foraging by diving to obtain food resources. Food items include seeds and leaves, snails, crustaceans, insects, tadpoles, and small fish. The species will travel long distances, including between islands, when local food sources are depleted.

Some important habitats are located in National Wildlife Refuges and State sanctuaries and these sites receive management attention. However, other important habitats are not protected. These mostly include wetlands facing development or those used for agriculture or aquaculture. Examples include: playa lakes on Niihau; Opaekaa marsh and Lumahai wetlands on Kauai; Amorient prawn farms, Laie wetlands, Uko, Punahoolapa, and Waihee marshes, Waialua lotus fields, and Waipio Peninsula ponds on Oahu; Paialoa and Ooia playa fishponds on Molokai; and Opaeula, and Waiakea-LokoWaka ponds on the island of Hawaii (Service 2005, pp. 15-16).

Life History

Life history and breeding biology are poorly documented. Nesting habitat includes freshwater and brackish ponds, irrigation ditches, and taro fields. Floating nests are constructed of aquatic vegetation and found in open water or anchored to emergent vegetation. Open water nests are usually composed of mats of bulrush (*Schoenoplectus* spp.), water hyssop (*Bacopa monniere*) and Hilo grass (*Paspalum conjugatum*). Nests in emergent vegetation are typically platforms constructed from buoyant stems of species such as bulrush (*Schoenoplectus* spp.). Nesting occurs primarily from March through September, although some nesting occurs in all months of the year. The timing of nesting appears to correspond with seasonal weather conditions (Service 2005, p. 16). Nest initiation is tied to rainfall as appropriate water levels are critical to nest success. Clutch size range from three to ten eggs, and precocial young hatch after a 25-day incubation period.

Threats and Conservation Needs of the Species

The threats to, and conservation needs of, Hawaiian waterbirds outlined above in the “Status of the Species” section for the Hawaiian stilt apply to the Hawaiian coot.

Ongoing Conservation Actions

A variety of conservation measures have been implemented to protect Hawaii’s endangered waterbirds. Efforts directly benefitting the Hawaiian coot include a long-term hunting ban, protection of habitat through establishment and management of Federal and State refuges and sanctuaries, and predator control. Actions that inform conservation of the species include a biannual waterbird survey conducted by DOFAW since the mid-1950s, population monitoring, and research.

Hawaiian Moorhen

Species Description

The Hawaiian moorhen is an endemic subspecies of the common moorhen (*Gallinula chloropus*). It is a dark gray bird with a black head and neck, and white feathers on their flanks and on their undertail coverts. They have a distinctive red frontal shield, and their bill tip is yellow with a red base. Their legs and feet are greenish and without lobes. The Hawaiian moorhen usually measures about 13 inches (32 to 35 centimeters) in length and 11 to 16 ounces (310 to 456 grams) in mass, with males typically larger and heavier than the female (Bannor and Kiviat 2002, online p. 2). Both sexes are similar and have chicken-like cackles and croaks. The Hawaiian moorhen is similar to the common moorhen on the mainland in appearance. In Hawaiian legend, these birds were thought to have brought fire from the gods to the Hawaiian people.

Listing Status

The Hawaiian moorhen was listed as an endangered species in 1967 (Service 1970), pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released on May 1999, followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4(c)(2) of the Act which requires five year review after listing. Critical habitat has not been designated for the Hawaiian moorhen (Service 2005, p. 3).

Historical and Current Distribution

No historical population estimates are available for the endemic Hawaiian moorhen. Because they are such 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). The State attempted a reintroduction of six moorhen (three females and three males) on May 18, 1983, to the island of Molokai at Kakahaia NWR. One of the banded birds was found dead January 2, 1985 and a local resident mistook the other five for chickens and they were consumed (Dibben-Young 2010, p. 58).

Hawaiian moorhens generally occur in wetland habitats below 410 feet (125 meters) elevation on the islands of Kauai and Oahu, although there have been reports from Keanae Peninsula on Maui and from the island of Hawaii. On Kauai, the largest populations occur in the Hanalei and Wailua river valleys. Hawaiian moorhens also occur in the irrigation canals on the Mana Plains of western Kauai and in taro fields. On Oahu, the species is widely distributed with most birds found between Haleiwa and Waimanalo; small numbers occur at Pearl Harbor and the leeward coast at Lualualei Valley. Historically, Hawaiian moorhens occurred on all the main Hawaiian Islands except for Lanai and Kahoolawe (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 (see Figure

5). 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.

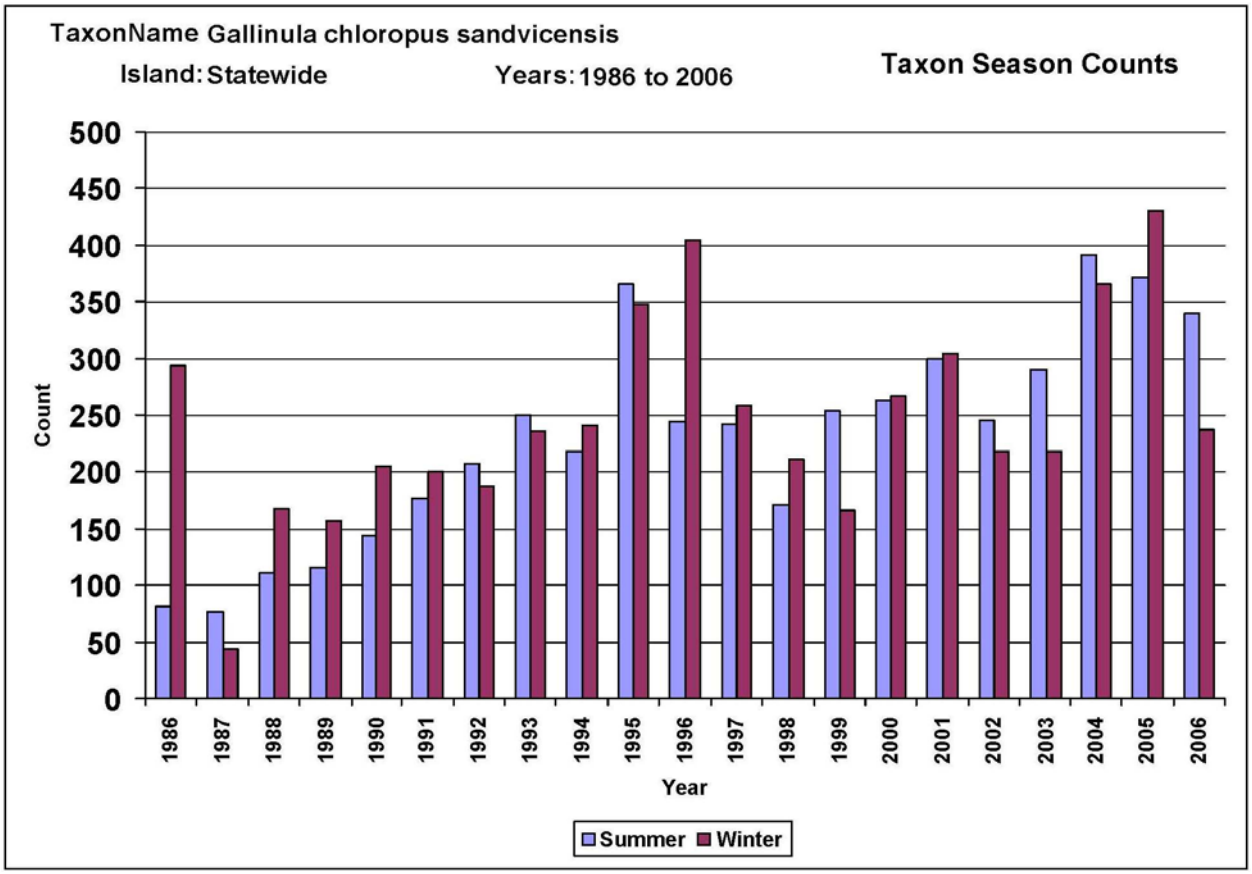

Figure 5. State Waterbird Surveys 1986 – 2006: Summer and Winter Counts of the Hawaiian moorhen. Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007

Ecology

Hawaiian moorhens are the most secretive of the native waterbirds, preferring to forage, nest and rest in dense late succession wetland vegetation. Most birds feeding along the waters edge or in open water will quickly seek cover when disturbed. The preferred habitat for moorhens includes interspersed dense stands of robust late succession vegetation near open water (approximately 50 percent water to 50 percent vegetation), floating or barely emergent mats of vegetation, and water depth less than 3 feet (1 meter) (Service 2005, pp. 22-23). Hawaiian moorhens are opportunistic feeders and their diet likely varies with habitat, but includes algae, grass seeds, insects, snails, introduced fishes, crustaceans, mollusks, emergent grasses, and wetland plants (Service 2005, p. 23).

Life History

Hawaiian moorhens nest year-round but appear to have two active seasons from November through February and May through August (Service 2005, p. 23). It is believed that the timing of nesting is related to water levels and late succession wetland vegetation. The Hawaiian moorhen usually lays an average of five to six eggs, although clutches have been up to 13 eggs, and incubation is about 25 days (Service 2005, p. 23). Nesting phenology is apparently tied to water levels and the presence of appropriately dense vegetation. Platform nests are constructed in dense vegetation over water or near the waters edge. The particular species of emergent plant used for nest construction is not as important as stem density and vegetation height (Service 2005, p. 23). Moorhens are a precocial species; chicks are covered with down and are able to walk, but are dependent on parents for several weeks. Re-nesting and multiple broods during one season have been observed.

Threats and Conservation Needs of the Species

The threats to, and conservation needs of, Hawaiian waterbirds outlined above in the "Status of the Species" section for the Hawaiian stilt apply to the Hawaiian moorhen. In addition to the overall Conservation Needs outlined in the Hawaiian stilt section, recovery of the Hawaiian moorhen would also include reestablishing populations on at least two additional islands (Maui, Molokai, Lanai, or Hawaii) (Service 2005, p. 74).

Ongoing Conservation Actions

A variety of conservation measures have been implemented to protect Hawaii's endangered waterbirds. Efforts directly benefitting the Hawaiian moorhen include a long-term hunting ban, protection of habitat through establishment and management of Federal and State refuges and sanctuaries, and predator control. Actions that inform conservation of the species include a biannual waterbird survey conducted by DOFAW since the mid-1950s, population monitoring, and research (Service 2005, pp. 58-64).

Hawaiian Duck

Species Description

The Hawaiian duck is one of two extant native duck species (Family: Anatidae) found in Hawaii and is closely related to the well-known, but non-native mallard. Both sexes are mottled brown and similar in appearance to a female mallard. Adult males have darker heads, with distinctive brown chevrons on the breast, flank and back feathers, and olive-colored bills (Engilis et al. 2002, online p. 2). Adult females are similar but are smaller than males on average and slightly lighter in color, with plainer, buff colored chin and back feathers. Hawaiian ducks have a mean weight of 604 grams (male) and 460 grams (female) (Engilis et al. 2002, online p. 2).

Listing Status

The Hawaiian duck was listed as an endangered species in 1967 (Service 1970), pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in 1978, and revised in 1985. The first draft of the second revision was released on May 1999,

followed by the second draft of the second revision in May 2005. A species review has not yet been initiated pursuant to Section 4(c)(2) of the Act which requires five-year review after listing (Service 2005, p. 3). Critical habitat has not been designated for the Hawaiian duck (Service 2005, p. 3).

Historical and Current Distribution

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 from sea level to 9,900 feet (3020 meters) elevation 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. On Oahu, populations are found in Kawainui, Hamakua, and Heeia marshes, James Campbell NWR, and in wetland habitats in or near Punahoolapa, Haleiwa, Pearl Harbor, and Lualualei Valley, although many of these are thought to be hybrids. On Maui, Hawaiian ducks are found in Kahului, Kanaha and Kealia ponds. On the island of Hawaii populations occur in the Kohala Mountains, in Pololu, Waimanu and Waipio valleys, and Mauna Kea (Service 2005, pp. 5-6, 9).

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 (Figure 7). 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.

Ecology

Hawaiian ducks occur in a wide variety of natural and artificial wetland habitats including freshwater marshes, flooded grasslands, coastal ponds, streams, montane pools, forest swamplands, taro, lotus, shrimp, and fish ponds, irrigation ditches, reservoirs, and mouths of larger streams (Service 2005, p. 10). Some important habitats are located on National Wildlife Refuges or on State lands and receive management attention. However, other important habitats are not protected. These mostly include wetlands facing development or those used for agriculture or aquaculture.

Hawaiian ducks forage in a wide variety of freshwater habitats, including artificial wetlands. Hawaiian ducks move between feeding and breeding habitats, and are known to move between Kauai and Niihau. The species typically forages in shallow water less than 5 inches (13

centimeters) deep. Like mallards, Hawaiian ducks are opportunistic and their diet includes snails, dragonfly larvae, earthworms, grass seeds, green algae, and seeds/leaf parts of wetland plants. Hawaiian ducks are usually found alone or in pairs and are wary, especially when nesting or molting, although during the winter they may gather in larger numbers to exploit abundant food resources (Service 2005, p. 10).

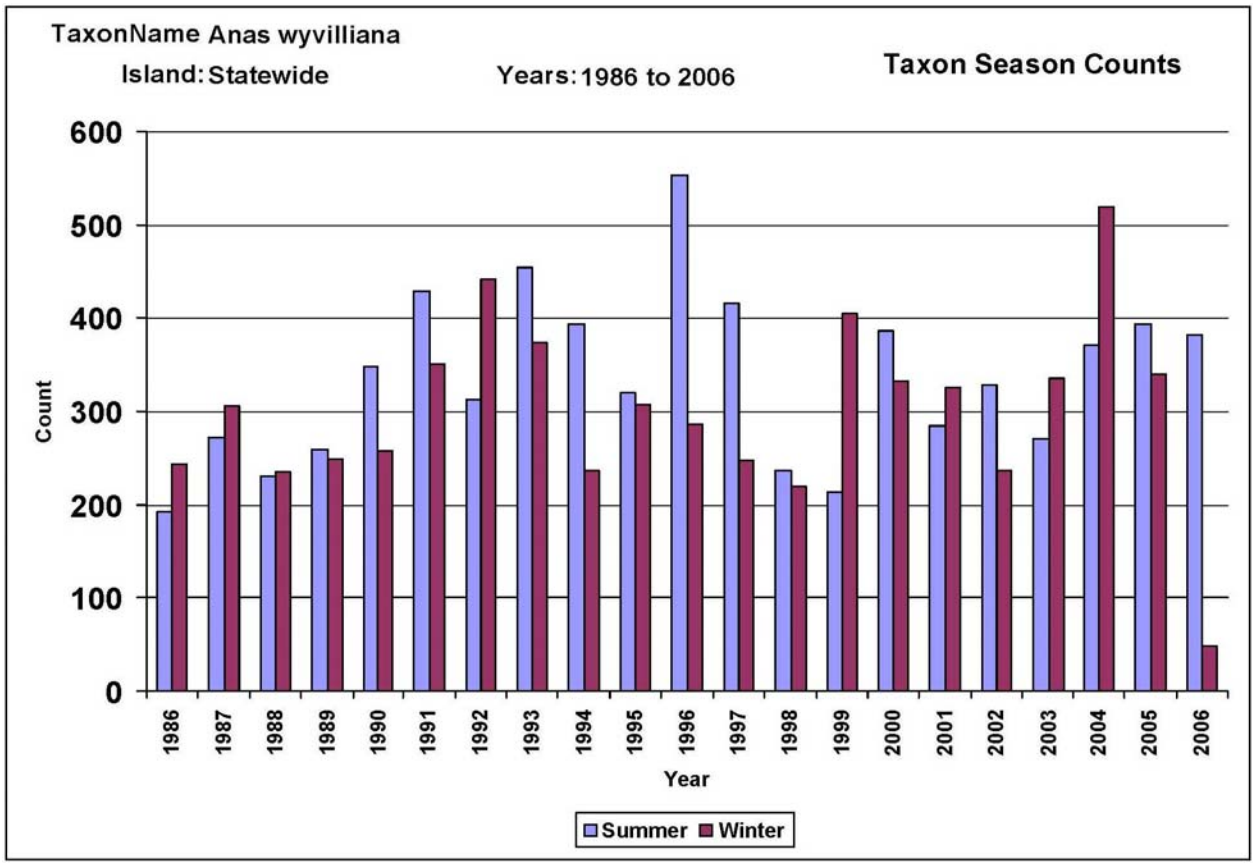

Figure 6. State Waterbird Surveys 1986 – 2006: Summer and Winter Counts of the Hawaiian duck. Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007

Life History

Hawaiian duck nesting biology is poorly understood. Although some pairs nest in lowland habitats on Kauai, Hawaiian ducks have also been observed nesting in the upper Alakai swamp (Service 2005, p. 10). Nesting occurs year round, but most activity occurs between January and May (Engilis et al. 2002, online p. 11). Nests are usually on the ground near water, but few nests are found in areas frequented by humans or areas supporting populations of mammalian predators. Generally eight to ten eggs are laid, and the precocial chicks hatch after an unknown incubation period, but likely less than 30 days.

Threats and Conservation Needs of the Species

The threats to, and conservation needs of, Hawaiian waterbirds outlined above in the "Status of the Species" section for the Hawaiian stilt apply to the Hawaiian duck. However, 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. In addition to the overall Conservation Needs outlined in the Hawaiian stilt section, 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).

Ongoing Conservation Actions

A variety of conservation measures have been implemented to protect Hawaii's endangered waterbirds. Efforts directly benefitting the Hawaiian duck include a long-term hunting ban, protection of habitat through establishment and management of Federal and State refuges and sanctuaries, predator control, release of captive-bred Hawaiian ducks, and restrictions on importation of mallards. Additional conservation actions include developing public service announcements (PSA) to make the general public aware of the hybridization issue facing the Hawaiian duck. Public service announcements for Hawaiian duck conservation were developed by The Wildlife Society and released in 2008. Studies that center on field identification of Hawaiian duck-mallard hybrids have been completed. Along with those studies, a Hawaiian duck-mallard hybrid outreach plan has been completed, and the ultimate goal is removal of the hybrid threat. Actions that inform conservation of the species include a biannual waterbird survey conducted by DOFAW since the mid-1950s, population monitoring, and research (Service 2005, pp. 58-64).

Hawaiian Hoary Bat

Species Description

The Hawaiian hoary bat is medium-sized (0.5 to 0.8 ounces) nocturnal, insectivorous bat, with a wingspan of 10.5 to 13.5 inches. "Hoary" refers to the white-tinged, frosty appearance of the bat's grayish brown or reddish brown fur. Although females are slightly larger than males, forearm lengths are similar in both genders. These bats are not colonial, and roost solitarily in tree foliage (Service 1998, pp. 8-10).

The Hawaiian hoary bat is classified under the Family Vespertilionidae of the Suborder Microchiroptera, and is one of three recognized hoary bat subspecies. The other two subspecies are *Lasiurus cinereus cinereus*, one of the most common and widespread bats in North America, and *Lasiurus cinereus vilosissimus*, which occurs in South America and the Galapagos (Shump and Shump 1982, pp.1-5). Morphologically, the Hawaiian hoary bat may have diverged significantly from the North American form, as Hawaiian hoary bats are about 45 percent smaller. Nonetheless, preliminary genetic analysis indicates the Hawaiian hoary bat may be derived from the North American hoary bat. The low degree of genetic divergence, however, suggests subspecies classification may be appropriate (Service 1998, pp. 8-9).

Listing Status

The Hawaiian hoary bat was listed as an endangered species in October 13, 1970 (Service 1970), pursuant to the Endangered Species Preservation Act of 1966. The original recovery plan was approved in May 11, 1998. A species five-year review has been conducted on September 30,

2011 pursuant to Section 4(c)(2). Critical habitat has not been designated for the Hawaiian hoary bat (Service 1970).

Historic and Current Distribution

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).

Life History

A comprehensive life history assessment for the Hawaiian hoary bat is lacking. Furthermore, the existing information on population status and habitat ecology is often conflicting. Hawaiian hoary bats roost in a variety of tree species, both native and non-native, during the day and forage in a wide range of habitat types during the night (Service 1998, pp. 12-13). There is no information on the Hawaiian hoary bat's average life span, age at first reproduction, and survivorship, or on how age and reproductive condition affect its food habits, habitat selection, home range size, and movement patterns.

A few studies have documented Hawaiian hoary bats in a wide range of locations and habitat types on the island of Hawaii. Bats observed along 611 miles (983 kilometers) of forest bird survey transects and incidentally elsewhere on Hawaii during 1976-1983, at elevations from sea level to 10,007 ft. (3,050 m), were more frequently associated with nonnative vegetation (64 percent), such as tall eucalyptus and other exotic plants, than with native vegetation (19 percent) (Kepler and Scott 1990, p. 61). Visual observations and echolocation detections at 22 sites in southeast Hawaii, however, found no significant differences in bat activity among native or non-native vegetation types (Reynolds et al. 1998, pp. 153-157). In addition, 57 percent of all bat activity was noted at open sites, forest edges, lava flows, volcanic pit craters, residential and agricultural clearings, and roads. Foraging bats at 14 survey sites over a range of altitudes were more frequently associated with native vegetation (44 percent) than non-native (16 percent) or mixed (9 percent) vegetation (Jacobs 1993, p. 22). Bats were detected most often in native mesic koa-ohia forest vegetation at 13 sites in, and adjacent to, Hakalau Forest National Wildlife

Refuge (Cabrera 1996, p. 238). All reports of bat occurrences may be biased to varying degrees by sampling efforts concentrated along roads and forest edges.

Roosting habitat for the Hawaiian hoary bat is sparsely documented. However, Dr. Frank Bonaccorso's current research project utilizing radio-tracking with more than 30 Hawaiian hoary bats, reveals all the bats studied roost in trees and all roost more than 20 ft. (6 m) off the ground (Bonaccorso 2009b, pers. comm.). North American hoary bats roost 10 to 16 ft. (3 to 5 m) above the ground, mostly in hardwood trees (Shump and Shump 1982, p. 3). Hawaiian hoary bats have been observed in a wide variety of trees, including native species (*Metrosideros polymorpha*; *Pandanus tectorius*; *Styphelia tameiameiae*), Polynesian-introduced species (*Aleurites moluccana*), and post-contact introduced species (*Syzygium cumini*) (Service 1998, p. 13). Bats also have been occasionally observed in fern clumps, low scrub, rock crevices, macadamia nut orchards, and buildings (Tomich 1986, p. II-24).

Hawaiian hoary bats forage in a variety of open and vegetated habitats, including open fields, lava flows, open ocean in bays near shore, and streams and ponds. Hawaiian hoary bats on Hawaii forage in both relatively closed habitats near vegetation (such as clearings in lowland mesic ohia forest or town parks) as well as in open habitats and forest edges (Jacobs 1993a; Tomich 1974, pp. 10–13). Foraging generally occurs 3 to 492 ft. (1 to150 m) above the ground or open water, 3 to 50 ft. (1 to 15 m) above the ground in closed forest habitats, and up to 100 ft (30 m) and more above tree canopy (Service 1998, p. 10).

As with other life history parameters, little is known about the breeding biology of Hawaiian hoary bats. Females of most temperate, autumn-breeding, insectivorous bat species become pregnant in the spring by delayed ovulation and fertilization, and young are cared for exclusively by the female. The breeding cycle of the Hawaiian hoary bat on the island of Hawaii consists of pregnancy (April to June), with pups born in May or June; lactation (June through early August and possibly to September); post-lactation, after pups have fledged (September to December); and pre-pregnancy (January to March) (Menard 2001, p. 35). Like North American hoary bats, Hawaiian hoary bat females are believed to give birth to two young at a time. North American hoary bat pups cling to the mother at the roost tree during the day, where she leaves them hanging on a twig while she forages at night (Shump and Shump 1982, p. 3), and Hawaiian hoary bats are presumed to behave similarly. Female North American hoary bats adjust their foraging behavior to meet the increasing energy demands of pregnancy and lactation (Barclay 1989, pp. 31-37). Because newborn bats cannot thermoregulate very well in tree-foliage roosts, the mother's foraging activity may be constrained by the need to roost periodically with her young to keep them warm. Thus, foraging behavior changes with reproductive condition, and females with non-volant young may forage at different times of night and perhaps in different habitats than other bats. Preliminary evidence indicates that pregnant and lactating female Hawaiian hoary bats on Hawaii may prefer roosting in lowland areas rather than in the cooler highlands, perhaps because the warmer lowland environment promotes faster juvenile growth (or, alternatively, because insect food sources may be more readily available) (Menard 2001, pp. 52-105).

Threats

The major threats to the Hawaiian hoary bat are assumed to be the same as those that threaten many bat species in general (Harvey et al. 1999, p. 13; Service 1998, p. 15). Bats have the

slowest reproductive rate and the longest life-span of all mammals of their size (Barclay and Harder 2003, pp. 209-256). Thus, any mortality of breeding-age adults, particularly females, constrains the recovery of the subspecies. The main factor limiting recovery was thought to be habitat loss, primarily the availability of roosting sites as suitable roosting habitat is particularly important to pregnant and lactating females and non-volant young (Service 1998, p. 15). Other possible threats identified in the recovery plan may include: roost disturbance, predation by native hawks and non-native feral cats, pesticide use (either directly or by impacting prey species), and alteration of prey availability due to introduction of non-native insects. In addition, occasional instances of Hawaiian hoary bat mortality due to collisions with vehicles and structures have been documented (Kepler and Scott 1990, p. 60; Kuhn 2009; Menard 2001, p. 136; Tomich 1986, pp. I 1-30). Clearing of vegetation in areas where there are non-volant bat pups may result in the injury or death of those young. Hoary bats also may 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.).

Conservation Needs of the Species

The overall recovery strategy for the Hawaiian hoary bat is to rely on research that can provide information on the subspecies' abundance and distribution, life history, and habitat associations. The primary recovery goal is to conduct research essential to the conservation of the Hawaiian hoary bat. Research should focus on developing standardized survey and monitoring protocols for determining abundance and distribution, roosting habitat associations, basic life history biology, and food habits. Other recovery goals are to protect and manage current populations by identifying and managing threats, including protection of key roosting and foraging areas; conduct a public education program; evaluate progress towards recovery; and revise recovery criteria as necessary (Service 1998, p. 18-20).

Ongoing Conservation Actions

The Service, Hawaii Department of Land of Land and Natural Resources – Division of Forestry and Wildlife (DOFAW), and Bat Conservation International (BCI, a non-profit conservation and education organization) are stakeholders in a public-private Hawaiian Hoary Bat Research Cooperative (Cooperative) which collaboratively prioritizes and funds management-oriented research on the Hawaiian hoary bat's abundance, distribution, and habitat requirements. Major stakeholders include private landowners, agricultural and commercial forestry interests, environmental groups, local governments, and Federal and State agencies. Most of the Cooperative's current funding is provided by the Service's Cooperative Endangered Species Conservation Fund (Section 6 of the Endangered Species Act) grants to the State. The Cooperative awarded funding to the U.S. Geological Survey – Biological Resources Division for telemetry research in years 2004 to 2007, to complete baseline surveys to document Hawaiian hoary bat movements on the island of Hawaii. The Cooperative has secured other funding to continue this research through 2009. The Service is also working with several private landowners in the state to develop Habitat Conservation Plans for the Hawaiian hoary bat. While none of these activities are occurring on the island of Oahu, all may provide conservation benefits to the population as a whole and provide essential information regarding policy and management decisions.

ENVIROMENTAL BASELINE

General Baseline Description

The Hawaiian hoary bat, the Hawaiian coot and Hawaiian ducks hybrids were detected within the Kawailoa Wind Power project area, however, no portion of the site has been designated as critical habitat for any listed species. Newell's shearwater-like targets were detected flying over the Kawailoa Wind Power project area during nocturnal radar surveys. The endangered Hawaiian hoary bat has been documented flying over the project area and bat activity has been recorded on the acoustic bat detectors.

Several federally listed endangered waterbird species occur regularly on adjacent properties and individuals of these species may occasionally transit through the airspace of the proposed Kawailoa Wind Power facility. All four covered waterbirds are known to occur regularly in the Ukoa Pond, which lies nearby the proposed Kawailoa Wind Power facility. Of these four species, only Hawaiian ducks or duck hybrids have been observed flying over the project site during the avian surveys conducted by Kawailoa Wind Power and SWCA (SWCA 2011HCP Appendix 4, SWCA 2009).

Status of the Species in the Action Area

Status of Newell's Shearwater in the Project Area and Off-site Communication Towers

Cooper et al. (2011) conducted surveillance radar and audiovisual sampling at the Kawailoa Wind Power project area in summer and fall 2009 to sample representative seabird passage rates over the site for use in estimating the risk of seabird take resulting from collisions with turbines and met towers. Supplementary radar surveys were conducted in June 2011 for 16 nights to measure passage rates over the north-eastern most turbine string. Two new areas were sampled for five nights each to increase radar coverage of the project site. Sites sampled in 2009 were also resampled for three nights each. Preliminary analysis of the data shows similar passage rates to those measured in 2009 both at the new sites and the resampled sites. The additional data are not expected to significantly change the average passage rate over the site.

Over five nights of sampling in June 2009, Cooper et al. (2011) recorded one landward-flying and 20 seaward-flying radar targets that fit the criteria for shearwater-like targets. In October 2009 one landward-flying and 52 seaward-flying radar targets were recorded over five nights of sampling. The mean movement rate across all nights and both sites was 0.60 ± 0.07 shearwater-like targets/h in summer 2009 and 1.41 ± 0.15 shearwater-like targets/h in fall 2009 (Cooper et al. 2011).

No visual identification of these targets was possible for both the 2009 and 2011 surveys; however, Cooper et al. (2011) suggests that the individuals were more likely to be potential Newell's shearwaters than Hawaiian petrels due to the timing of movements. This is based on surveys conducted on other islands, Newell's shearwaters move to the interior portions of the islands starting about 30 minutes after sunset, while Hawaiian petrel movements begin at sunset and go to about 60 minutes after sunset (Day et al. 2003b). Additionally, Cooper et al. (2011) indicated that the fall radar data were highly likely to include an unknown proportion of plovers (thus conservatively inflating movement rates used in the shearwater fatality models) based on

observations of Pacific golden-plovers during fall sampling, the difficulty of separating plover targets from shearwater targets on radar, and the higher movement rates observed in fall when lower numbers of shearwaters are expected to occur. Due to the high possibility of high target contamination in the fall, the passage rates of Newell's shearwaters were modeled based on summer movement rates only resulting in an annual movement rate of 731 bird passes/year over the entire site.

The Newell's shearwater has not been confirmed as a nesting species on Oahu (Ainley et al. 1997) as no nesting colonies have been found. There have been infrequent incidental reports of downed fledglings in the last 50 years (roughly one a decade) for the Island of Oahu (Cooper et al. 2011). Assuming the detected birds were Newell's shearwaters, then their observed behavior of flying to and from the Koolau Range suggests that at least a small number of these birds are at least prospecting for nesting sites in these mountains. Because of the few detections obtained during the Day and Cooper study and lack of radar studies from adjacent lands, it is not known whether the Kawailoa Wind Power project area lies within a primary corridor used by these few birds as they move between their prospective nesting areas and the ocean. Observations of Newell's shearwaters in the Hawaiian Islands indicate that approximately 75% of shearwaters will fly at or below turbine height (Cooper et al. 2011).

No radar studies were conducted at the off-site microwave facility sites because the proposed antennae will be mounted on existing towers, the antennas are not expected to significantly increase the collision risk of any Covered Species if they should happen to transit the tower location.

Role of the Action Area in the Conservation of the Newell's Shearwater

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 impractical and likely ineffective in terms of contribution to recovery. Mitigation work will be implemented on the island of Kauai where approximately 90 percent of the populations nesting occurs and a greater conservation benefit can be achieved. Tier 2 mitigation can occur either on Kauai or Maui Nui to be determined at the time Tier 2 take occurs. The selection of the site will be guided by the Service and DOFAW at that time to protect the colony for the greater conservation benefit or establish a new colony and protected area which would be the case for Kahoolawe.

Status of the Hawaiian Stilt in the Project Area, the Vicinity and Off-site Communication Towers

No Hawaiian stilts were seen flying over the proposed Kawailoa Wind Power facility during the avian point count surveys conducted by SWCA or Hobdy (SWCA 2010; Hobdy 2010a, b). No stilts have been observed occupying the water bodies that were surveyed (SWCA 2010; Hobdy 2010a, b). Two irrigation ponds occur within the 1 km airspace envelope around the lowest turbine string (Zone 1 (See Figure 7)) that may potentially be attractive to Hawaiian stilt. No other coastal wetlands are present within the airspace envelope of the turbine strings. Waimea River is a perennial stream, and is within the airspace envelope of the upper most turbine sting (Zone 3 (See Figure 7)); however, stilts are not expected to be present in Waimea River as they require early successional marshlands for nesting and foraging (Service 2005). However,

because of the known dispersal capabilities of these birds (Reed et al. 1998), it is expected that individual stilts can fly over the Kawailoa Wind Power project area on a very irregular basis while moving between wetlands or islands.

There are no open water features near the communication sites; therefore, no waterbirds are expected. There are no open water features near proposed location of the off-site communication towers, and waterbirds have not been historically documented at Mount Kaala (DLNR 1990). In addition, none of the listed waterbird species have been observed at the sites (Hobdy 2010c; Steve Mosher 2009 pers. comm.)

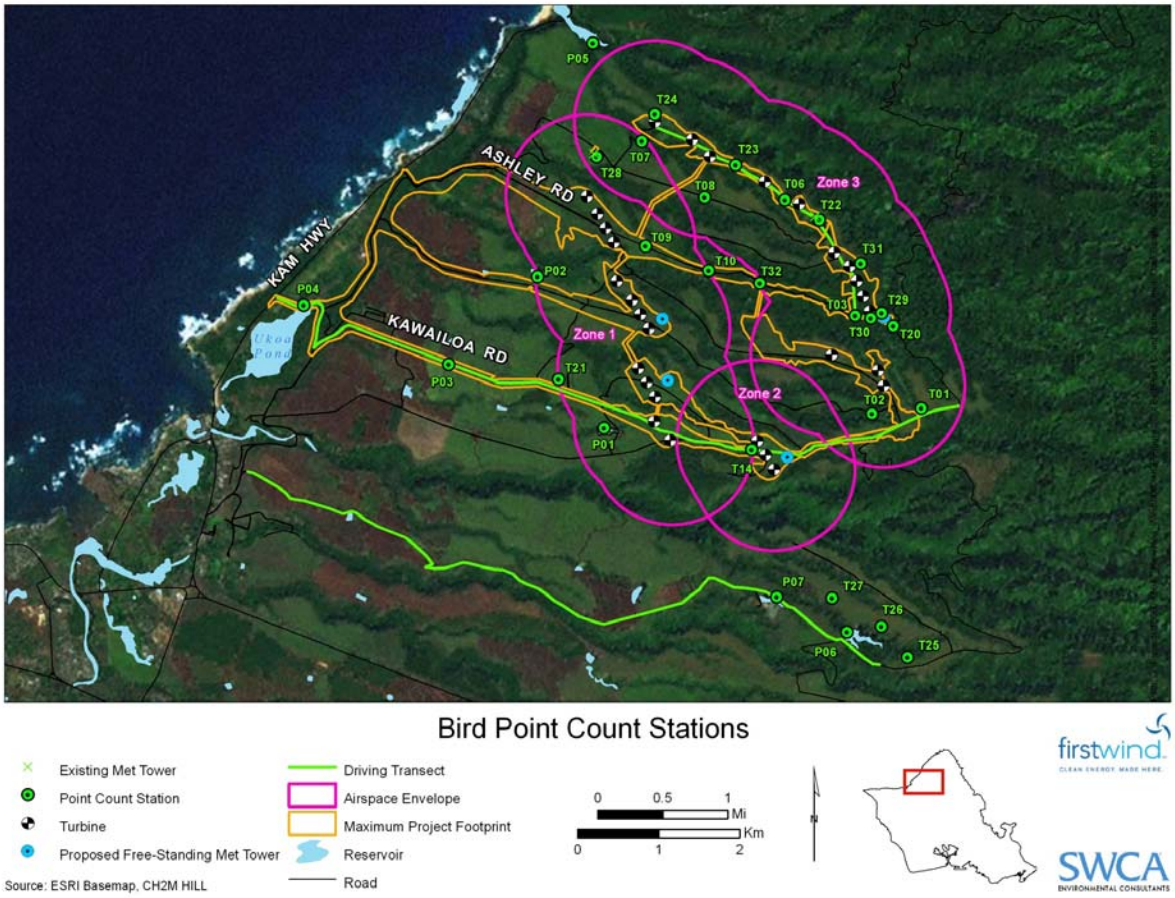

Figure 7. Bird Point Count Stations and Turbine Airspace Zones.

Role of the Action Area in the Conservation of the Hawaiian Stilt

No coastal wetlands are present within the airspace envelope of the turbine strings. The mitigation site is Ukoa Pond, which 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 Hawaiian stilt is that 75% of the supporting wetlands are protected and managed according to the practices outlined in the recovery plan. The restoration of Ukoa Pond will increase the available protected habitat for the Hawaiian stilt.

Status of the Hawaiian Coot in the Project Area, the Vicinity and Off-site Communication Towers

One observation of the Hawaiian coot was made at an adjacent irrigation pond, in September 2010. This individual was foraging in the pond when observed and did not take flight. This individual was not present when subsequent observations were made later in September. Two irrigation ponds also occur within the 1 km airspace envelope around the lowest turbine string (Zone 1(See Figure 7)) and may be attractive to Hawaiian coot. No other coastal wetlands are present within the airspace envelope of the turbine strings. Waimea River is a perennial stream, and is within the airspace envelope of the upper most turbine string (Zone 3; see Figure 7), however, coot are not expected to be present in Waimea River as they are primarily a species of the coastal plains (Service 2005). Hawaiian coots are known to disperse between islands and coupled with the one-time observation of a foraging coot at P03, there is potential for coots to occasionally fly over the lower elevations of Kawailoa Wind Power project area if moving between foraging sites or islands. No suitable habitat for Hawaiian coot occurs on the Kawailoa Wind Power project area.

There are no open water features near proposed location of the off-site communication towers, and waterbirds have not been historically documented at Mount Kaala (DLNR 1990). In addition, none of the listed waterbird species have been observed at the sites (Hobdy 2010c; Steve Mosher 2009 pers. comm.)

Role of the Action Area in the Conservation of the Hawaiian Coot

No coastal wetlands are present within the airspace envelope of the turbine strings. The mitigation site is Ukoa Pond, which 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 Hawaiian coot is that 75% of the supporting wetlands are protected and managed according to the practices outlined in the recovery plan. The restoration of Ukoa Pond will increase the available protected habitat for the Hawaiian coot.

Status of the Hawaiian Moorhen in the Project Area, the Vicinity and Off-site Communication Towers

No Hawaiian moorhens were detected during the year of avian point count surveys on the Kawailoa Wind Power project area. However, Hawaiian moorhen have been seen regularly at nearby water bodies and may potentially be attracted to the two irrigation ponds within the airspace envelope of the lower turbine string (Zone 1(See Figure 7)). Hawaiian moorhen were observed in flight only once in December, where two individuals were made a short flight 7 m below the stream bank at P05. A total of three individuals have been detected at P05 and have responded to moorhen call playbacks on three occasions. These moorhen are likely resident at P05. Hawaiian moorhen were also seen at two locations at Ukoa Pond during a site visit by SWCA biologist on November 30, 2010. Hawaiian moorhen have not been seen at any of the other water bodies and moorhen playbacks have not elicited any response in any of these areas.

A total of 10 moorhen are also resident in the lotus ponds in Waimea Valley (Laurent Pool, Conservation Land Specialist, Waimea Valley, pers. comm.). Three moorhen adults and two chicks were seen by SWCA biologists on a visit conducted on April 23, 2010. However,

Hawaiian moorhen are not expected to be present in the upper reaches of Waimea River, within the airspace envelope of Zone 3 (See Figure 7), due to the lack of suitable habitat. Given their ability to fly and their occurrence at Waimea Valley, Hawaiian moorhens are likely to fly over the project area, especially the lower elevation portion.

There are no open water features near proposed location of the off-site communication towers, and waterbirds have not been historically documented at Mount Kaala (DLNR 1990). In addition, none of the listed waterbird species have been observed at the sites (Hobdy 2010c; Steve Mosher 2009 pers. comm.)

Role of the Action Area in the Conservation of the Hawaiian Moorhen

No coastal wetlands are present within the airspace envelope of the turbine strings. The mitigation site is Ukoa Pond, which 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 Hawaiian moorhen is that 75% of the supporting wetlands are protected and managed according to the practices outlined in the recovery plan. The restoration of Ukoa Pond will increase the available protected habitat for the Hawaiian moorhen.

Status of the Hawaiian Duck in the Project Area and Off-site Communication Towers

Ducks resembling Hawaiian ducks (but likely to be hybrids) have been seen flying over Zone 1 (Figure 7) of the Kawailoa Wind Power project area. A total of 10 sightings of the Hawaiian duck-mallard hybrids have been recorded on-site (five during point count surveys, four incidental sightings and one sighting during driving transects). Flock sizes ranged from one to 15 birds with an average size of four birds. Similar to the black-crowned night heron, birds were observed in flight at the ponds in the area or flying near the lower met tower on Kawailoa road (Bird point count station T21(Figure 7)) or in the area between the met tower and bird point count station P01. However, one incidental sighting was also reported along the road between count stations T28 and T07. No flocks were seen within the altitude of the rotor swept zone (RSZ) of the proposed turbine (approximately 50 m altitude or above).

Thus, while flying over the Kawailoa Wind Power project area, ducks may be vulnerable to colliding with the WTGs, and met towers. The risk is probably highest in Zone 1, given that no waterbird activity (ducks or otherwise) was observed in the other zones. Passage rates of ducks were only applied to Zone 1 and the estimated passage rate area is 0.054 birds/ha/hr. The passage rate of ducks in Zone 2 and 3 is presumed to be zero (SWCA 2010a).

There are no open water features near the proposed location of the off-site communication towers, and waterbirds have not been historically documented at Mount Kaala (DLNR 1990). In addition, none of the listed waterbird species have been observed at the sites (Hobdy 2010c; Steve Mosher 2009 pers. comm.)

Because of the hybridization of Hawaiian ducks with feral mallards, it is questionable whether any pure Hawaiian ducks are resident on Oahu (Browne et al. 1993; Uyehara et al. 2007; Service 2005). Given the dispersal capabilities of the species, it is possible for pure Hawaiian ducks to occasionally fly over from Kauai. Genetic research in 2007 showed presence of several

Hawaiian ducks at James Campbell National Wildlife Refuge, and a bird struck by a plane at Honolulu International Airport in 2005 was later found to be Hawaiian duck (Wright 2008).

Role of the Action Area in the Conservation of the Hawaiian Duck

No coastal wetlands are present within the airspace envelope of the turbine strings. The mitigation site is Ukoa Pond, which 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 Hawaiian duck is that 75% of the supporting wetlands are protected and managed according to the practices outlined in the recovery plan. The restoration of Ukoa Pond will increase the available protected habitat for the Hawaiian duck.

Status of the Hawaiian Hoary Bat in the Project Area and Off-site Communication Towers

Two to nine Anabat detectors have been deployed at various locations on the Kawailoa Wind Power project area beginning in October 2009. These studies are presently on-going, with detectors being moved to new locations from time to time to increase the area sampled will continue throughout the life of the project. Anabat detectors detect the presence of bats by recording ultrasonic sounds emitted by bats during echolocation.

A total of 2,466 detector nights were sampled from October 2009 to January 2011 at 19 locations (SWCA 2011a HCP Appendix 4). During this period, bat activity over the entire site occurred at an average of 0.12 bat passes/detector night. The bat activity rates on site were divided into higher and lower activity periods. Higher activity periods were months with an average bat activity greater than 0.1 passes/detector night. Lower activity periods were months with an average of less than 0.1 passes/detector night. The higher activity period for Kawailoa Wind Power was between the months of March to November with an average activity rate of 0.15 passes/detector night for that period (Figure 8). February was excluded as a month with higher bat activity as 95% of the call sequences were detected on February 28. June and October were included in the higher bat activity period as these months are bracketed by months that are considered "higher activity". (Figure 8). The low activity period occurs during the months of December through February with an average activity rate of 0.045 passes/detector night (Figure 8, SWCA 2011a HCP Appendix 4). The data suggest that bat activity increases from March through November and is lowest or absent in the winter. Bat activity was recorded throughout the project area within a wide variety of landscape features, including clearings, along roads, along the edges of tree lines, in gulches and at irrigation ponds. Bat calls are also distributed throughout the night (Figure 8). The overall detection rates at Kawailoa Wind Power are approximately five times lower than the detection rates at Hakalau Forest National Wildlife Refuge (0.66 passes/detector night) (Bonaccorso, USGS unpublished report) but are ten times the rates at Kaheawa Wind Pastures and Kahuku Wind Power, both of which have an activity rate of approximately 0.01 bat passes/detector night (SWCA 2010d).

At Kawailoa Wind Power, bats may roost in the trees present in the area and bat activity has been detected in essentially all habitats, including clearings, along roads, along the edges of tree lines, in gulches and at irrigation ponds. Monitoring to date indicates that bats use all of these features for travelling and foraging.

The actual number of bats represented by the detections made by the Anabat detectors on the Kawailoa Wind Power site is not known. Bat activity rates are not necessarily indicative of the number of bats (Kunz et al. 2007) as Anabat detectors cannot differentiate between many bats passing the detector once and one bat passing the detector multiple times. Thus, the higher activity rates observed at Kawailoa Wind Power could be due to an increase in bat numbers in the area or an increase in usage of the area by the same number of individuals or a combination thereof. The reported bat activity rates are also relative, rather than absolute measures of bat activity at the site. While the Anabats were placed in a variety of locations and vegetation types to ensure good representation of the site, these Anabats were not randomly placed at each location but situated in spots sheltered from wind, along roads or edges of vegetation to maximize the probability of detecting a bat.

Cooper et al. (2009) visually observed two Hawaiian hoary bats on-site incidental to the seabird radar survey in June 2009, but no bats in October 2009. Those observations translated to an estimated summer occurrence rate of 2 bats in 84 25-min observation sessions (i.e. 0.057 bats/h or approximately 0.68 bats/night (assuming 12 hrs of night)). Both bats were flying at an altitude of ≤5 m (Cooper et al. 2009). Given these results, it is presumed that a number of Hawaiian hoary bats forage over the Kawailoa Wind Power project area on a somewhat regular, though possibly seasonal, basis. These bats may also roost in the area.

No surveys for Hawaiian hoary bats were conducted at the microwave facility sites. Given the native forest that surrounds the microwave facility sites, bats may be expected to forage and roost in the area at least occasionally.

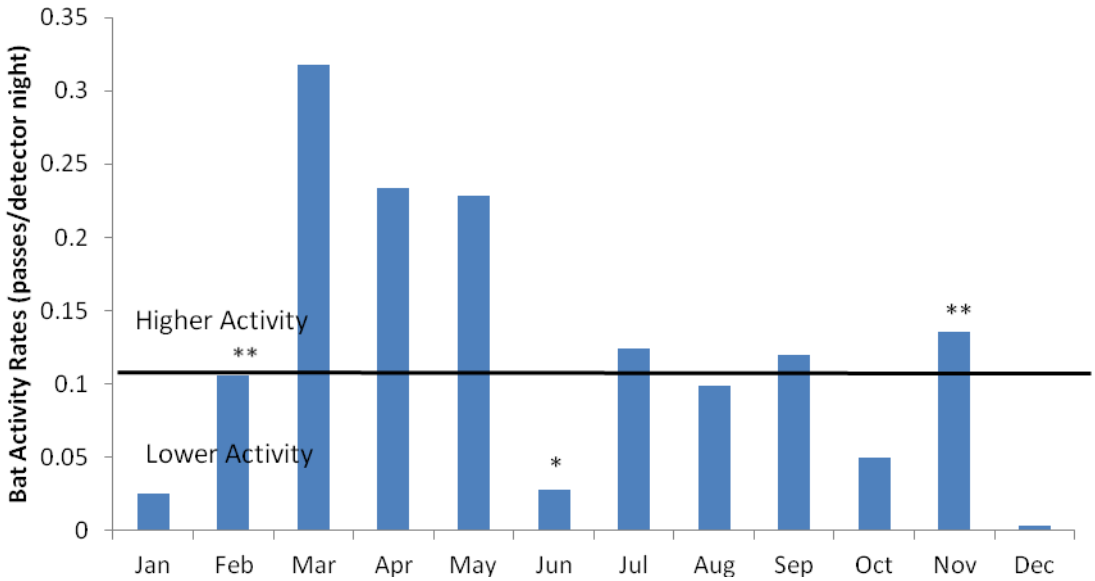

Figure 8. Distribution of Bat Passes Over Survey Period.
Higher activity month = 0.1 passes/detector night or greater; Lower activity month= less than 0.1 passes/detector night
*the drop in June was probably due to the low sampling effort for that month (37 detector nights) which occurred due to operator error and equipment shortage
**the increases in November and February were due to a large number of calls recorded in one night (on November 15, 30 of 49 call sequences were recorded in a span of 30 minutes; on February 28, 36 of 39 call sequences were recorded in a span of 1.5 hrs)

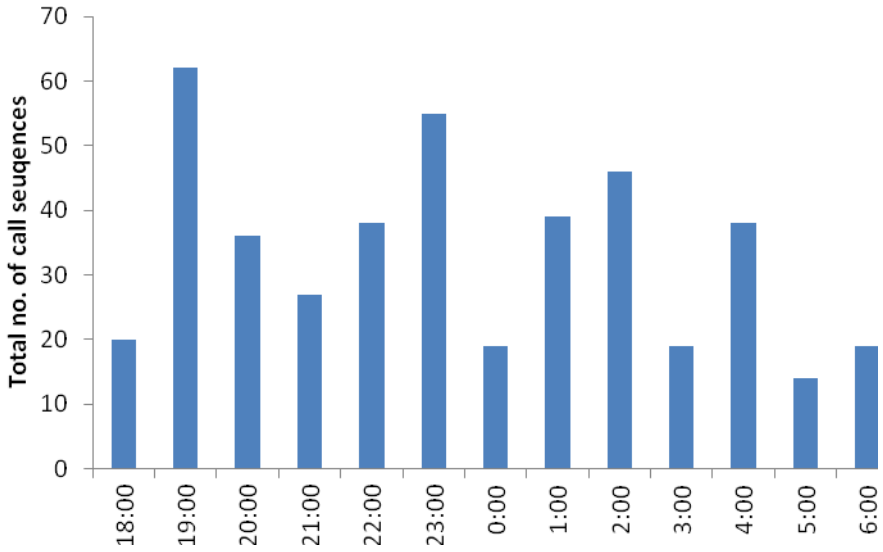

Figure 9. Time Distribution of All Bat Calls Detected.

Role of the Action Area in the Conservation of the Hawaiian Hoary Bay

A widespread population of Hawaiian hoary bats must be naturally reproducing and stable or increasing in size on the island of Hawaii for a minimum of five consecutive years before downlisting is considered. Hawaiian hoary bat populations on Hawaii, Kauai, and Maui must be well distributed, naturally reproducing, and stable or increasing in size for at least five consecutive years following downlisting before delisting is considered. Thus, Oahu is not identified for the recovery of Hawaiian hoary bats (Service 1998 p. iii).

EFFECTS OF THE ACTION

Effects of Construction Footprint

No direct impacts to listed species are expected to result from on-site habitat disturbance. The only listed species with the potential to occur regularly in the project area is the Hawaiian hoary bat, which has shown very low but regular activity rates on-site and could roost in trees on the property. Hawaiian hoary bats are known to breed at low elevations, so it is possible dependent juvenile bats occur in the project area during the months of June to August. In order to avoid potential for harm to non-volent juvenile bats, no clearing of trees for construction will occur when Hawaiian hoary bats are expected to have pups (June through September 15).

Direct Effects of Collisions with Project Structures

Construction and operation of the Kawailoa Wind Power project with its proposed wind turbine generators (WTGs), on-site and off-site microwave towers, one permanent unguyed met tower, overhead collection lines and relocated distribution line would present the potential for collisions by the Newell's shearwater, listed waterbirds, and Hawaiian hoary bat. The potential for each listed species to collide with the project components was identified based on the results of the on-site wildlife surveys and the proposed design (SWCA 2011a HCP Appendix 3 and 4). Collisions with project structures may result in injury or mortality. When on the ground, injured

birds may be subject to predation by mongooses, cats, or dogs, or susceptible to vehicle collisions. However, an enforced speed limit of 15 mph should minimize the potential for such collisions.

Fatality estimate models were developed by Kawailoa Wind Power that incorporated rates of species occurrence, observed flight heights, rates of interaction with turbines and met towers, and assumptions regarding the likelihood of collision/avoidance as covered bird species encounter air space occupied by project components. The last factor was then varied in the models to create a range of probabilities of mortality (collision) for each species on an annual basis. Visual avoidance by seabird and waterbird species is not supported by any evidence.

Recent studies on the mainland indicate that most bat fatalities occur at relatively low wind speeds, and consequently the risk of fatalities may be significantly reduced by curtailing operations on nights when winds are light and variable. Research suggests this may best be accomplished by increasing the cut-in speed of wind turbines from their normal levels (usually 3.5 or 4 m/s, depending on the model) to 5 m/s. Two years of research conducted by Arnett et al. (2009, 2010) found that bat fatalities were reduced by an average of 82% (95% CI: 52–93%) in 2008 and by 72% (95% CI: 44–86%) in 2009 when cut-in speed was increased to 5 m/s. No significant additional improvement over this level was detected when the cut-in speed was increased to 6.5 m/s. Kawailoa Wind has implemented curtailment at 5 m/s to avoid impacts to Hawaiian hoary bat.

Indirect Effects of Collisions with Project Structures

In addition to direct impacts such as mortality or injury of listed species resulting from collisions with project components, indirect impacts may also occur. For example, it is possible that adult birds killed through on-site collisions are tending to eggs, nestlings, or dependent fledglings, or adult bats could have been tending to dependent juveniles. The loss of these adults would then also lead to the loss of the eggs or dependent young. Loss of eggs or young would be an indirect impact attributable to the proposed action.

Estimated annual injury or mortality resulting from the Kawailoa Wind Project for each of the covered species addressed in the HCP in Table 1. Also included for each species is an estimate of indirect take based on expected level of direct take. As discussed in Monitoring of the HCP (Section 8.2), the amount of total impacts attributed to the project (adjusted) will be identified annually. Total impacts will be assessed using observed direct impacts (actual individuals found during post-construction monitoring plus indirect impacts) and an estimate of unobserved direct take based on searcher efficiency and scavenging trial results.

Development of a Self-Resetting Cat Trap and Deployment at a Newell's Shearwater Colony

The development of a more efficient cat trap is consistent with one of the recovery milestones identified by in the Recovery Plan for the Hawaiian Petrel and Newell's Shearwater (Service 1983) and the 5-Year Work Plan for Newell's Shearwater (NESH Working Group 2005). The recovery plan states that one of the primary management objectives for the two species are: "Developing efficient predator control methods and techniques for use in and around isolated nesting sites." The Newell's Shearwater (NESH) Working Group developed a 5-Year Work Plan for Newell's Shearwater (NESH Working Group 2005) which outlines specific recovery

objectives for the Newell's Shearwater that can be met within five years. The first recovery objective is also to "Minimize adult/breeder mortality and maximize fledgling production by developing and implementing effective predator control methods in colonies".

Goodnature Limited (http://www.goodnature.co.nz/), a New Zealand based company, is currently seeking funding to develop a self-resetting cat trap. The funding is anticipated to result in a trap that specifically targets cats while excluding sensitive species. The trap will dispatch the cats humanely and then will self-reset multiple times so that the traps are active again without human intervention. The prototype will be commercially available 12 months after the funding is received. These traps will be tested in a location where cats are common in Hawaii, to demonstrate the effectiveness and efficiency of the trap.

Concurrently, a Newell's seabird colony will be identified and a pilot study will be designed where these traps are deployed to provide localized control of cats over an area where birds are known to be breeding. The study will be designed by Goodnature Limited and Kawailoa Wind Power will be responsible for the implementation of the study by the first Newell's shearwater breeding season after the trap becomes commercially available. The cat trap will be deployed for one breeding season and based on modeling of a reduction from medium to mild predation (HT Harvey and Associates 2011), the cat trap deployment is expected to result in a 10% increased breeding probability, 7.5% increased breeding success and 1.5 - 2.5% increase in survival of adults and subadults that are protected within the trapped area from cats. Modeling shows that within one year, for 20 active burrows protected, the reduction of cat predation could potentially result in the additional survival of 0.5 adults, 4.1 juveniles and 2 fledglings. For 30 burrows, the accrual after one season is expected to be 0.8 adults, 6.1 juveniles and 2.9 fledglings (HT Harvey and Associates 2011).

The preferred location for the seabird colony is Kauai, but Maui may be selected with Service and DOFAW approval. Seabird colonies currently under consideration include, but are not limited to, Wainiha Valley, Limahuli Valley and Hono O Na Pali on Kauai, or Makamakaole and a potential seabird colony at Upper Kahakuloa Valley on Maui.

Tier 2 Contributing to a Restoration Fund for Predator Control and Translocation or Social Attraction of Newell's Shearwater

Although providing mitigation on Oahu for most 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 contribution to recovery.

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. Kahoolawe and its surrounding waters were under control of the U.S. Navy from 1941 to 1994. Over fifty years of use as a live-fire training area have significantly impacted the landscape, although there were efforts to remove unexploded ordinance. Kahoolawe and its surrounding waters were conveyed back to the State of Hawaii in 1994, and

since then, Kahoolawe and the waters within two nautical miles of its shores have been designated as a reserve, and the State of Hawaii has established the Kahoolawe Island Reserve Commission (KIRC). The commission is committed to environmental and cultural restoration of Kahoolawe, and with funding and partnership with various groups. With respect to the restoration of seabird colonies, KIRC identifies two main efforts in its 2010 report: the eradication of invasive mammals and the removal of marine debris. Feral cats are rampant on Kahoolawe, and have ravaged the island's seabird population. In partnership with the Service and Island Conservation, the development of an operational and management plan is underway, and a feasibility study to remove invasive mammals has been completed. The contributions by Kawailoa Wind Power to predator control at the site and the eventual translocation of Newell's shearwater to a managed area within Kahoolawe are expected to aid in establishing a new Newell's shearwater seabird colony within Maui Nui.

Effects of Waterbird Mitigation at 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. This 40-acre unit is currently overgrown by invasive species particularly water hyacinth (*Eichhornia crassipes*) and bulrush (*Schoenoplectus varieties*) but is still connected to a small body of open water. There is a source of flowing water nearby due to a previously capped well and the area is close to an access point where equipment and materials to manage the site can be staged. The removal of the invasive vegetation is likely to increase the amount of open water available and should be attractive to waterbirds. The overall goals of the restoration and management of the 40 acres unit is to attract waterbirds to the managed site and provide immediate protection from predators through fencing and predator control to encourage breeding and increase productivity. A Memorandum of Agreement to solidify the partnership between Kawailoa Wind Power and Kamehameha Schools are being developed for the management of the site throughout the life of the project to ensure the long-term management of Ukoa Pond when mitigation activities are completed.

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.

There is a possibility that the proposed project may increase the risk for an outbreak of avian botulism. Botulism can occur in any area with standing fresh or brackish water frequented by waterbirds. Flooding or draining the pond can change environmental conditions sufficient to stop the bacterium that causes botulism (Work 2008, pers. comm.). Therefore, adequate flows to provide water circulation have been incorporated into the project through a variety of methods (pumps, water control structures, and gravity feed diversions). A Management Plan will be developed within six months of permit issuance, which will include methods to surveillance for outbreaks, response measures such as draining of ponds and removal of carcasses, and post-outbreak waterbird population monitoring.

The Hawaiian ducks are declining primarily due to hybridization with mallard ducks (Service 2005, p. 11). Mallard with Hawaiian duck hybrid populations on Oahu are increasing based on State bi-annual waterbird survey data (Figure 10). An estimated 300 hybrid Hawaiian ducks are present on Oahu (Engilis et al. 2002, Service 2005). 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 Applicant will manage the Ukoa Pond to remove hybrids. Strategies for implementing culling will be outlined in a Management Plan for Ukoa Pond that will be approved by the Service and DOFAW prior to its implementation.

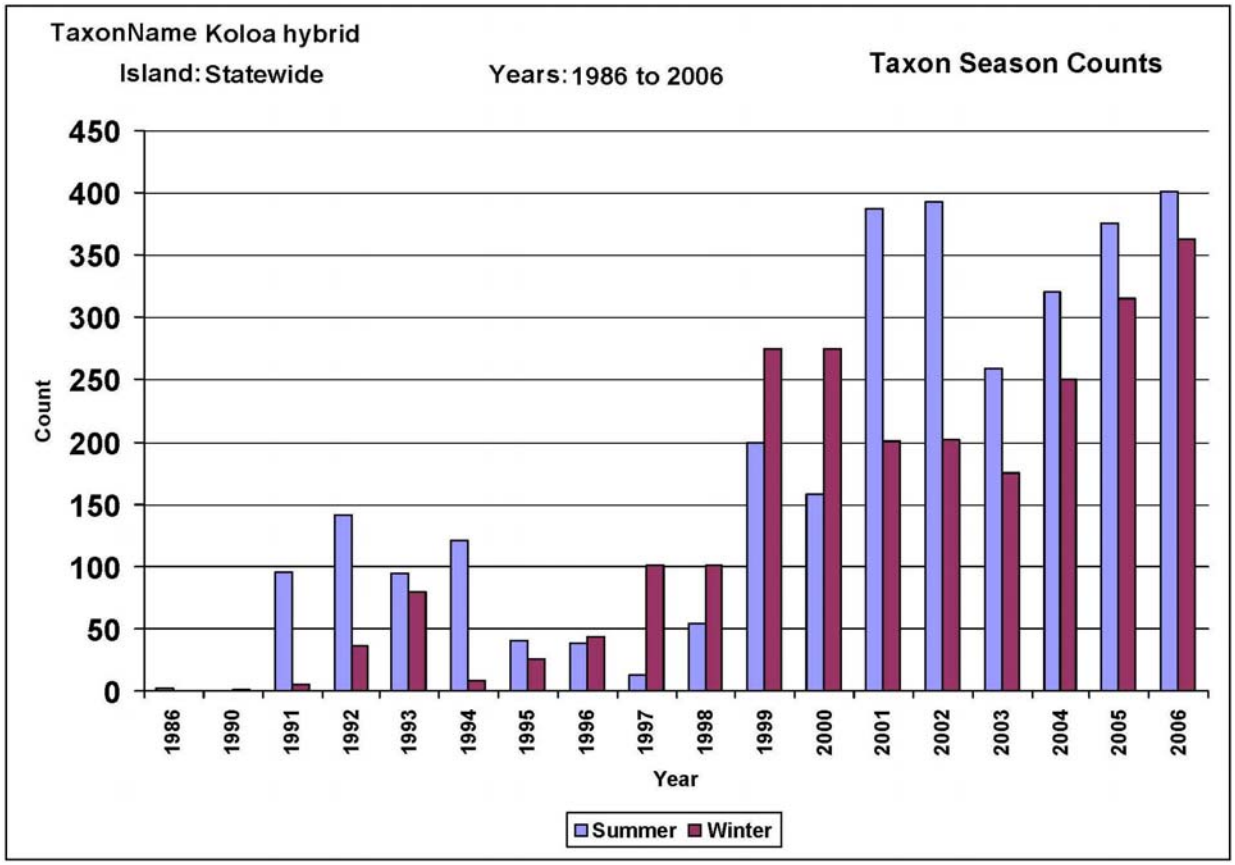

Figure 10. State Waterbird Surveys 1986 – 2006 Summer and Winter Counts Hawaiian duck Mallard Hybrids Data: Hawaii Waterbird Database-Hawaii Natural Heritage Program/University of Hawaii 2007

Effects of Predator Control on Hawaiian Moorhen

There is a potential for waterbirds to be accidentally trapped in the predator traps. However, based on past and ongoing work on the Oahu NWR Complex, the Hawaiian coot, Hawaiian stilt, and the Hawaiian duck have never been documented in the traps within the Oahu NWR Complex units, during trapping efforts that have been implemented since 1992. Although Hawaiian ducks have been caught in live traps on Kauai, based on current Hawaiian duck hybrid studies conducted by Andy Engilis of University California at Davis, it is not likely that a Hawaiian duck will be present within the Ukoa Pond, based on current population levels.

On July 7, 1994 an adult Hawaiian moorhen was found dead in one of the traps a Hanalei 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 (re-captures) 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.

Effects of Hawaiian Hoary Bat Mitigation at Ukoa Pond or Forest Restoration

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. 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. 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.

The habitat restoration will be conducted 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 1. Forty acres of wetland will be restored as mitigation for waterbirds. If the wetland restoration area is increased to 80 acres to accommodate bat mitigation, it is anticipated that the additional restored areas will also attract waterbirds. Therefore, the overall acreage for both waterbirds and bats will be 80 acres of restored wetland habitat at Ukoa Pond.

Research will quantify the success of the mitigation and components of the research will document changes in bat activity from pre- to post-restoration, to support the hypothesis that wetland restoration improves foraging habitat for bats and results in greater survival and increased productivity. Mist-netting and visual surveys will be used to document changes in bat utilization of the area. If the number of pregnant bats or juveniles caught increase over time, this will also demonstrate that increased reproductive success is occurring at the restored wetland or forest, as compared to baseline (pre-restoration) levels. These data will be used to determine if the increase in survivorship and productivity at the restored wetland or forest has been sufficient to compensate for the requested take in Tier 1. 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 an integral part of the research that will have to be fulfilled as part of the mitigation.

If after five years it is determined that the wetland 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. Mitigation measures may 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.

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.

In addition the Applicant will conduct further research to investigate the reasons for the take, and additional measures to reduce the take will be implemented if possible. The research will further advance avoidance and minimization strategies that wind facilities in Hawaii and elsewhere can employ in the future to reduce bat fatalities.

Summary of Effects of the Action in relation to Conservation Needs of the Covered Species and the Role of the Action Area in the Conservation Needs of the Covered Species

Newell's shearwater
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. 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 Maui Nui.

Hawaiian Waterbirds
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. The restoration of Ukoa Pond increases available managed wetland habitat, thereby increasing population numbers through increasing nesting success, fledging success, and increased protected habitat.

Hawaiian Hoary Bat
At Kawailoa Wind Power, bats may roost in the trees present in the area and bat activity has been detected in essentially all habitats, including clearings, along roads, along the edges of tree lines, in gulches and at irrigation ponds. Monitoring to date indicates that bats use all of these features for travelling and foraging. The primary recovery goal is to conduct research essential to the conservation of the Hawaiian hoary bat. Ukoa Pond restoration or the forest enhancement site on Oahu will be implemented to increase and improve bat foraging and roosting habitat which will lead to increased adult and juvenile survival and increased productivity. Data will be collected and used to determine if the increase in survivorship and productivity at the restored wetland or forest has been sufficient to compensate for the requested take. 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.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Endangered Species Act.

Take for the Covered Species has been authorized for projects occurring on Maui and Kauai through HCPs (Table 4). Under the Federal ESA HCPs are required to minimize and mitigate the effects of the incidental take to the maximum extent practicable. In addition to the above requirements, the State of Hawaii requires that all HCPs and their actions authorized under the plan should be designed to result in an overall net benefit to the threatened and endangered species in Hawaii being authorized for incidental take (Section 195D-30). These agreements assure property owners they will not be subjected to increased property use restrictions if their efforts attract listed species to their property or increase the numbers or distribution of listed species already on their property. The Service issues the applicant an “enhancement of survival” permit, which authorizes any necessary future incidental take through Section 10 (a)(1)(A) of the ESA. Accordingly, all impacts associated with these take authorizations will be mitigated.

Table 4. Current and Pending Take Authorizations for Covered Species on Maui through proposed HCPs.

Applicant	Permit Duration	Location	Species and Total Take Authorization
Kaheawa Wind Power II	Pending	Maalaea, Maui	Newell’s shearwater (6 adults,4 chicks) Hawaiian hoary bat (9 adults,6 juveniles)
Auwahi Wind Energy	Pending	Ulupalakua Ranch, Maui	Hawaiian hoary bat (19 adults, 8 juveniles)

In addition to the take that has already been authorized (Table 4), the other proposed wind energy projects include Na Pua Makani wind facility project on Oahu, and Kauai Wind Power project on Kauai also have the potential to result in incidental take of, and contribute to cumulative impacts to, the Covered Species. There is currently ongoing unmitigated take on the

Island of Kauai of couple hundred Newell's shearwaters fledglings each year (SOS Database). To address this a second HCP is under development on Kauai to address take of the Hawaiian petrel, and Newell's shearwater due to light attraction. The Kauai Seabird Habitat Conservation Program (KSHCP) would cover incidental take of existing and planned facilities with outdoor lights as well as overhead utility lines. The types of applicants seeking authorization include resorts and condominiums, small businesses, state agencies, the County of Kauai, and KIUC. However KIUC is the only entity applying for authorized incidental take due to power line strikes; all others would be applicants for incidental take, seeking coverage for light attraction. The KSHCP, as proposed, would also authorize weed, ungulate, and predator removal carried out under the compensatory mitigation program to benefit covered seabirds and other listed plants and animals. The proposed term of this HCP is 30 years and its earliest anticipated permit date is fall 2012. However, it is expected that if the HCPs for any or all of the potential projects are approved, the impacts and mitigation measures will resemble those discussed for Kawailoa Wind Power, where the proposed mitigation measures are expected to offset the anticipated take and provide a net benefit to the species.

CONCLUSION

After reviewing the current status of the species, the environmental baseline for species in the action area, and the effects, construction impacts and management activities, including the cumulative effects, it is our biological opinion that implementation of the proposed action is not likely to jeopardize the survival and recovery of the Newell's shearwater, Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, Hawaiian duck, and the Hawaiian hoary bat because, as discussed in this Opinion, under the HCP the status of these species in the action area is likely to be benefitted in a manner that is consistent with their conservation needs and the role the action area plays in that conservation. No critical habitat has been designated for these species; therefore, none will be affected.

A summary of the primary reasons supporting the no jeopardy conclusions is presented below for each of the Covered Species.

Newell's Shearwater

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 Newell's shearwater population will however, have a beneficial effect as a result of implemting the proposed mitigation.

The Tier 1 requested take is for five shearwaters over 20 years, which would result in an annual rate of take of shearwaters of 0.4 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 Statewide. Specifically on Oahu with the preponderance of threats the island could be acting as a sink to individuals that attempt to nest. 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 Maui 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 benefitting populations on Maui and Kauai, cumulative effects are not anticipated to have any significance effects because any proposed projects will be implemented to have beneficial impacts through mitigation and the limited role the action plays in the conservation of this species on Oahu, the proposed project 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 action area for this species.

For the above reasons, no decline in the likelihood of the stilt'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 stilt.

Hawaiian Coot

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, coupled with the mitigation to offset impacts, and 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 decline 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 decline 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 lead 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 decline 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.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations promulgated pursuant to section 4(d) of the Act prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The proposed Kawailoa Wind Energy Facility HCP and its associated documents clearly identify anticipated impacts to affected listed species likely to result from the proposed taking and the measures that are necessary and appropriate to minimize and mitigate those impacts. All conservation measures described in the proposed HCP, together with the terms and conditions described in any associated Implementing Agreement and any section 10(a)(1)(B) permit or permits issued with respect to the proposed HCP, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement pursuant to 50 CFR 402.14(i). Such terms and conditions are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the Act to apply. If Kawailoa Wind Power fails to adhere to these terms and conditions, the protective coverage of the section 10(a)(1)(B) permit and section 7(o)(2) may lapse. The amount or extent of incidental take anticipated under the proposed Kawailoa Wind Energy Facility HCP is as described in the HCP and its accompanying section 10(a)(1)(B) permit. Associated reporting requirements and provisions for disposition of dead or injured animals are described in the section 10(a)(1)(B) permit.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

- The Kawailoa Wind LLC should fund Sea Life Park at an appropriate level to support evaluation and rehabilitation efforts of migratory bird species impacted at the wind turbine site.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION STATEMENT

This concludes formal consultation on the subject proposed action. As provided in 50 CFR § 402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operation causing such take must cease pending reinitiation.

If you have any questions regarding this Opinion, please contact Aaron Nadig, Fish and Wildlife Biologist, Consultation and Habitat Conservation Planning Program (phone: 808-792-9473, fax: 808-792-9581) at the Pacific Islands FWO.

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