Kaheawa Pastures Wind Energy Generation Facility
Habitat Conservation Plan

Annual Report

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I. EXECUTIVE SUMMARY

In June 2006 Kaheawa Wind Power, LLC (KWP) began operating the island of Maui's first commercial wind energy generation facility in the Kaheawa Pastures area of West Maui. Among the conditions imposed by the State Board of Land and Natural Resources (BLNR) was a requirement to "comply with the Incidental Taking Permit requirements of the U.S. Fish and Wildlife Service, including the preparation of the Habitat Conservation Plan."

This report summarizes how KWP has implemented the provisions of the HCP from inception (summer 2005) through December 2006, including measures to minimize the risks of adverse effects on the four listed species (i.e., take), monitor the effects of the project, and mitigate potential take to accomplish a net ecological benefit to the species.

Beginning prior to road construction activities and lasting throughout the entire construction phase of the project (August 2005-May 2006), pre-construction Nene clearing surveys were performed daily. In addition, on-site construction personnel promptly reported any birds that happened to fly into areas adjacent to construction activity to the Senior Wildlife Biologist. Immediate action ensured that operations could proceed at no risk to Nene or other wildlife in the vicinity.

About mid-way through the construction phase KWP biologists began providing a weekly written summary of daily Nene surveys and results to DLNR and USFWS. These reports contained the results of daily clearing surveys for Nene along with a short narrative describing Nene distribution and behavior on the site.

We began performing nesting surveys for Nene in August, 2005, prior to the initiation of construction activities. Surveys were conducted within KWP and adjacent buffer zones, in consultation with DLNR and USFWS, to ensure that the construction would not inadvertently disturb nesting activities. We did not discover any active Nene nests on site, though in consultation with DLNR we did monitor the status of one nest located well to the south of the lower site boundary and on one occasion observed a single family group.

We also performed systematic observations to document Nene flight interaction and avoidance behavior with respect to the wind turbines and other project structures. Observations suggest Nene are capable of anticipating structures and exhibiting avoidance behavior relative to stationary and moving structures in their airspace.

We continue to work closely with DLNR and USFWS to identify a site on Maui for the construction of a new Nene release pen and to facilitate the captive propagation of Nene goslings to provide a "bank" of mitigation in advance of any actual take.

KWP began planning for investigations of breeding colonies of Hawaiian Petrels and Newell's Shearwaters in interior portions of the West Maui Mountains early in the implementation of the draft HCP. In 2006 we visited three remote sites in West Maui for a total of seven nights and mornings of observation resulting in five petrel/shearwater detections.

We used ornithological radar and infra-red night vision to assess movement of Hawaiian Petrels and Newell's Shearwaters through the KWP project area during the summer and fall of 2006. Results generally were in agreement with patterns reported in past studies of seabird movement through the area and our observations suggest that shearwaters and petrels may be capable of detecting the turbine structures and altering their flight behavior to avoid obstacles in their flight paths.

Systematic night vision enhanced surveys were performed to examine the occurrence of Hawaiian Hoary Bats at KWP. No positive detections have thus far been documented. One bat was observed during seabird colony searches in Waihe`e Valley.

During both construction and operational phases of the project we implemented Wildlife Education and Observation Protocol (WEOP) orientations for all staff and contract personnel. A Wildlife Observations Logbook enables staff and contract personnel to enter the details of their observations of HCP covered wildlife. The Logbook has proven an effective means of obtaining observations that might otherwise have not been possible relying on verbal communication alone.

KWP commissioned consulting botanist Robert Hobdy to provide an assessment of risks to sensitive or federally listed endangered plant species within wind turbine Fatality Search Plots (WTG 1-4) and the adjacent Manawainui Gulch State Plant Sanctuary and Papalaua Gulch. No ESA-listed species were identified in the search plots.

No downed wildlife or fatalities have so far been observed at KWP. Fatality monitoring began within days of the first operational rotation of turbine components. These searches have continued on a regular basis and amount to over 534 man hours of search effort. Carcass Trials and Searcher Efficiency Studies have suggested that our search frequency is adequate to discover most avian fatalities within one week of deposition.

The $20,000 payment to support bat research was provided by KWP in late 2006 per the direction of DLNR. In addition, contingency funds have been established for each of the covered species as specified in the HCP.

Topics that may warrant further discussion include the effects of wildfires on implementing searches, possibilities for vegetation management, and avoidance and minimization of impacts to the plant sanctuary communities.

We are pleased with how the first year of HCP implementation has proceeded. It is our expectation that as we continue to maintain close adherence to the set of compliance and monitoring initiatives set forth in the HCP we will meet the challenges and goals as set forth in the coming year and look forward to working closely with our agency partners to achieve successful avoidance, minimization, and mitigation – and in fact a net benefit - on behalf of the covered species and their habitats.

II. INTRODUCTION

In June 2006 Kaheawa Wind Power, LLC (KWP) began operating the island of Maui's first commercial wind energy generation facility in the Kaheawa Pastures area of West Maui. The State Board of Land and Natural Resources (BLNR) approved a Conservation District Use Application (CDUA MA-103) for the proposed facility, which is situated on State conservation lands, in January 2003. Among the conditions imposed by the BLNR was a requirement to "comply with the Incidental Taking Permit requirements of the U.S. Fish and Wildlife Service, including the preparation of the Habitat Conservation Plan."

Pursuant to Section 10(a)(1)(B) of the Endangered Species Act (ESA) of 1973, as amended, the U. S. Fish and Wildlife Service (USFWS) may permit, under certain terms and conditions, the "taking" of a listed species that is incidental to, and not the purpose of, an otherwise lawful activity. To qualify for a federal Incidental Take Permit (ITP) an applicant must develop, fund, and implement a USFWS-approved Habitat Conservation Plan (HCP) to minimize and mitigate the effects of the incidental take. Under a similar program, Chapter 195-D, Hawai`i Revised Statutes authorizes the Hawai`i Department of Land and Natural Resources (DLNR) to issue an Incidental Take License (ITL).

In fulfillment of this condition, KWP began developing a project-specific HCP in June 2004 in cooperation with the USFWS, DLNR and the Hawai`i Endangered Species Recovery Committee (ESRC). On June 24, 2005 the BLNR removed the condition requiring completion of the HCP prior to construction, and replaced it with a condition requiring that KWP immediately begin implementing the draft HCP, which was near completion at the time. This change allowed construction of the project to begin in fall 2005, while at the same time ensuring that the provisions of the HCP would be carried out and that listed wildlife species and other sensitive resources on the site would be protected. As a result, implementation of HCP began in late summer 2005, several months in advance of issuance of the state and federal permit and license. Upon final approval of the HCP, the ITP and ITL were issued in January 2006, during construction but prior to operation of the wind energy project. Both permits have a duration of twenty (20) years.

This report summarizes how KWP has implemented the provisions of the HCP from inception (summer 2005) through December 2006, including measures to minimize the risks of adverse effects on the four listed species (i.e., take), monitor the effects of the project, and mitigate potential take to accomplish a net ecological benefit to the species.

Covered Species

The HCP anticipates that the incidental take of four listed species (Hawaiian Petrel, Newell's Shearwater, Nene, and Hawaiian Hoary Bat) may potentially occur as a result of the operation of the wind farm. These species presently, or may, fly in the vicinity of the project site and could be injured or killed if they collide with a wind turbine. No other listed, proposed or candidate species have been found or are known to be present in the project area.

The Hawaiian Petrel is known to nest primarily on Maui and, to a lesser extent, on Kaua`i and Lana`i. On Maui, these petrels are known to nest on Haleakala Crater on East Maui; however, it is not known with certainty whether they also nest in the West Maui mountains in the project vicinity. The anticipated take of the Hawaiian Petrel in conjunction with the operation of the wind energy generation facility is a maximum of one individual per year. When indirect impacts are taken into consideration, the overall take is not expected to exceed 1.5 birds per year on average.

The Newell's Shearwater breeds on several of the main Hawaiian Islands, with indications that the species may also nest on Maui, although the status of the species on Maui is unclear at this time. Like the Hawaiian Petrel, the anticipated take of the Newell's Shearwater is a maximum of one individual per year. When indirect impacts are taken into consideration, the overall take is not expected to exceed 1.5 birds per year on average.

As part of the State and Federal plans for Nene recovery, Nene have been re-introduced onto the islands of Kaua`i, Maui, Moloka`i and Hawai`i; this recovery program includes a captive-release pen in the Hanaula area of the West Maui mountains, near the upper end of the project site. As of 2003, 87 Nene had been released from this pen since 1994, but little is known about their exact distribution and movements. The anticipated take of the Nene is two individuals per year. When indirect impacts are taken into consideration, the overall take is not expected to exceed three birds per year on average.

Lastly, little is known about the distribution or habitat use of the Hawaiian Hoary Bat. While it has been recorded on several islands, it is believed to be most abundant on Hawai`i and present in low numbers on Maui. The anticipated take of the Hawaiian Hoary Bat in conjunction with the operation of the wind energy generation facility is one per year.

Wind Farm Construction

KWP began construction in late summer 2005. Site development included construction of an access road leading upslope from the Honoapiilani Highway near McGregor Point, West Maui, more or less following the alignment of an existing jeep road system. A new spur road was constructed leading from the existing jeep road to the site in order to minimize the overall length of new road construction required. Once access roads enabled equipment to be staged, on-site development included the construction and erection of twenty (20) 1.5 MW wind-generation turbines and their foundations, an operations and maintenance facility, a substation and wind monitoring equipment, two meteorological towers (30 and 60m tall, respectively), all in the immediate vicinity of the wind turbines. Construction was substantially completed in June 2006, at which time the project was commissioned and became operational.

Summary of HCP Implementation

The status of impact avoidance, minimization and mitigation measures contained in the HCP are summarized below (Table 1).

TABLE 1. Habitat Conservation Plan principle implementation items and compliance timeline.

Mitigation Measure	Compliance Phase	Compliance period	Status
Nene clearing surveys [1, 2, 3]	Construction	Construction -- June 2006	Completed
Nene weekly reporting [3]	Construction	Construction -- June 2006	Completed
Nene nesting surveys [1, 2]	Year 1	October 2005 -- May 2006	Completed
Nene Interaction Surveys [3, 4]	Operations	Year 1 and 2	Active
Nene Release Pen [4]	Operations	Year 1 and 2	Active
Nene Gosling Production [4]	Operations	Years 1 -- 5	Active
Nene Contingency Fund [4]	Permit Issuance	Project Duration	Active
Seabird colony searches [4]	Operations	Year 1 and 2	Active
On-Site Radar Surveys [2, 3]	Operations	Year 1 and 2	Active
Seabird Contingency Fund [4]	Permit Issuance	Project Duration	Active
Incidental Bat Observations [3, 4]	Operations	Year 1 and 2	Active
On-Site Bat Surveys [3]	Operations	Year 1 and 2	Active
Hoary Bat Research Fund [4]	Permit Issuance	One-time allocation	Active
Hoary Bat Contingency Fund [4]	Permit Issuance	Project Duration	Active
Downed Wildlife Surveys [3]	Operations	Project Duration	Active
Carcass Removal Trials [3]	Pre-Operations	Year 1 and 2	Active
Searcher Efficiency Studies [3]	Operations	Year 1 and 2	Active
WEOP Implementation [1, 2, 3]	Pre-Operations	Project Duration	Active

1=impact minimization, 2=impact avoidance, 3=documentation and reporting, 4=mitigation

The following narrative provides a summary of HCP implementation activities and results. Selected data sets derived from monitoring are contained in appendices at the end of the report. Monitoring protocols follow those prescribed in the HCP.

III. NENE

1. Pre-Operational Nene Clearing Surveys

Beginning prior to road construction activities and lasting throughout the entire construction phase of the project (August 2005-May 2006), pre-construction Nene clearing surveys were performed daily, according to the methods prescribed in the HCP. Typically, pre-construction clearing surveys began at about 06:00, well in advance of the initiation of construction activities, and generally required about 1.5-2 hours to complete. These surveys were performed consistently (6 days per week) for the duration of the site development phase. Construction personnel were briefed regularly in accordance with Wildlife Education and Observation Program (WEOP) protocols (see below) and communication on Nene occurrence and observations within the survey area occurred between the biologist performing the surveys and the construction team supervisors to assure that birds were outside the potential interaction zone prior to commencement of daily construction activity and vehicle traffic.

Surveys were performed by slowly driving through the access corridor, pausing to carefully examine areas where objects or landscape features inhibited a clear view through the extent of the buffer zone on either side of the survey area. Where necessary, or when banded Nene were observed, the surveyor would stop the vehicle and attempt to read the bands and take notes on location and apparent behavior. There were no mishaps or breaches in protocol that resulted in any undesirable Nene interactions during the construction phase.

In accordance with the WEOP, on-site construction personnel promptly reported any birds that happened to fly into areas adjacent to construction activity after pre-construction clearing surveys were completed to the Senior Wildlife Biologist. Immediate action would generally entail an exchange of verbal information followed by the biologist arriving to record observations, document the situation, and ensure that operations could proceed at no risk to Nene or other wildlife in the vicinity.

2. Nene Weekly Reporting

About mid-way through the construction phase KWP biologists began providing a weekly written summary of daily Nene surveys and results to DLNR and USFWS to enable a more consistent and timely exchange of information. The first of these reports was produced on January 6, 2006. Reports were submitted weekly to John Medeiros, District Wildlife Biologist in charge of Nene management on Maui. When requested, we also provided copies of reports to DLNR and USFWS personnel in Honolulu. These reports contained the results of daily clearing surveys for Nene along with a short narrative describing Nene distribution and behavior on the site. This was a valuable exercise, not only because of the communication that it fostered between KWP and its agency partners, but also because it provided some useful insights on daily activity patterns and habitat associations of Nene in this particular region. This reporting regime continued for the remainder of the construction phase.

3. Nene Nesting Surveys

The breeding and nesting season for Nene generally lasts from October through April, though there may be some nesting activity observed days or weeks prior to and following this period. We began performing nesting surveys for Nene in August, 2005, prior to the initiation of construction activities. Surveys were conducted within KWP and adjacent buffer zones, in consultation with DLNR and USFWS, to ensure that the construction would not inadvertently disturb nesting activities. These surveys also established a baseline of breeding activity and apparent habitat use by Nene in the area. Nesting surveys were performed on foot and were designed to provide coverage of the site as a whole, while dedicating more intensive effort in areas known to contain quality nesting habitat based on recent and historical data. In addition, surveys focused on portions of the site where construction activities were anticipated or likely to occur.

While performing area-wide nest searching sweeps one active nest (WM06-07) was discovered about 500 meters downslope of the southern-most wind turbine pad (WTG-20). Area-wide sweeps were periodically performed in an effort to learn how much nesting activity might be occurring at the periphery of KWP in order to anticipate the level of subsequent family group activity that might occur as the season progressed. At the time this nest was discovered in early December, the WTG-20 pad had not yet been completed, and additional heavy mechanized equipment work would be required prior to the estimated hatch date for this nest. Although technically outside of the buffer zone, it was determined that the nest should be monitored in the interest of caution. In particular, concerns were raised about the potential effects of ground vibrations and noise on the behavior of the incubating adult pair and the eggs at the nest site. Therefore, a plan was developed in consultation with DLNR to monitor the nest remotely during the proposed pad development activity. Preparations were made to install a video monitoring station at the nest site that could be monitored in real time from a distance of about 300 meters on a lap-top computer via a microwave receiver. However, on the afternoon of January 17, as final preparations were being made, a final check of the nest revealed that the clutch had hatched. No signs of predation were observed and it appeared that the family group had moved away from the immediate nest site. Continued observations in the area strongly suggested that the family group was no longer in harm's way, and work was allowed to resume at WTG-20 with continued monitoring.

In a separate incident, on January 12, 2006 KWP personnel received a report of a family group composed of two adults and two goslings in the vicinity of WTG-3. The group was reported seen twice within a 30 minute period. They appeared to be moving downslope, perhaps using the jeep road as a travel corridor. When observed on the second occasion the birds moved quickly into the vegetation and were not seen again. All personnel working on site were alerted to the presence of a family group that may have been working their way downslope towards favorable foraging habitat. Partial band combinations were obtained during the initial observations and in consultation with DLNR, evidence suggested that this pair may have successfully nested on the Hanaula side of the ridge, based on historical nesting data for a closely matched pair possessing bands resembling our observations, and may have walked onto the site. No subsequent observations of goslings or family groups were ever made or reported.

We continued to search for nests and monitor breeding activity of Nene throughout the KWP project area and beyond to a distance of at least 100 meters throughout the remainder of the breeding and nesting season. We defined the project area as the physical boundaries of the KWP leased lands and immediate operational area including the conservatively estimated adjacent buffer zones. No active nests were identified anywhere on KWP.

4. Systematic Observations of Nene Activity to Evaluate Interaction with Wind Turbines and Apparent Avoidance Behavior

In June of 2006, the KWP facility was commissioned and entered the operational phase. At this time regular and systematic observation sessions were initiated to document Nene flight interaction and avoidance behavior with respect to the wind turbines and other project structures. Observations are being performed in accordance with the protocols established in the HCP under Mitigation for Potential Impacts.

Surveys are being performed visually on a weekly basis for a minimum of three hours per week (Appendix 2). Generally a site is chosen that enables a clear view of a significant portion of the wind turbine string, given current weather conditions. A survey consists of one to two observers scanning the airspace with the naked eye and binoculars, in anticipation of birds passing through in flight. Often, birds can be heard vocalizing before they are seen, which provides the observer(s) time to prepare for estimating flight altitude (height above ground in meters), specific location and distance relative to wind turbines, behavior, and to obtain photos if possible to document interaction with structures.

The majority of Nene transiting the site fly in a generally east-west direction, which is essentially perpendicular to the north-south turbine layout. From the early days of observation it appeared that Nene were not only very aware of the structures as obstacles but were also exhibiting behavior that strongly suggested avoidance. This apparent avoidance behavior could be seen as birds carefully passed between turbine tower structures, slowed their flight speed, and adjusted their flight direction and altitude to avoid rotors in motion (Figure 1).

Figure 1. A flock of four adult Nene in flight passing between wind turbine towers and negotiating moving rotors at the Kaheawa Pastures Wind Energy Facility, West Maui, Hawaii, June 2006.

Repeated observations suggest Nene are capable of anticipating structures and exhibiting avoidance behavior relative to moving structures in their airspace. Moreover, no near misses were observed during any surveys that would suggest birds had difficulty adjusting course or were significantly compromised in their flight paths. Surveys will continue through the remainder of the first year of operation (June 2007). Future efforts will include attempting to obtain observations during periods of reduced visibility and crepuscular conditions using IR night-vision goggles and/or ornithological radar.

5. Support for the Construction of an Additional Nene Release Pen

KWP has been in regular contact with DLNR since summer 2005 regarding the HCP requirement for construction and operation of a new Nene release pen on Maui. This process remains in the land acquisition phase with DLNR. DLNR has informed us that the site selection and land negotiations are continuing. Once DLNR has selected the site and secured agreements with land owners, KWP may then play a more active role in completing this task.

6. Nene Captive Propagation: Gosling Production as an Advanced Mitigation Measure

This component of the HCP will provide a "bank" of mitigation in advance of any actual take. Captive propagation of additional Nene goslings to compensate for take is tied to the construction of the new release pen, because existing facilities on Maui are currently operating at or near their capacity. (see above)

KWP has inquired of DLNR whether there is an alternative way that additional captive propagation can be accomplished prior to construction of the pen. So far DLNR has indicated that this is not possible because the needed capacity for propagation is still lacking. However, we remain interested and open to alternatives for making progress on this item.

7. **Nene Contingency Fund**

The $264,000 contingency fund for Nene mitigation is one of three funds prescribed under the HCP, which together total $384,000. The other two funds include a $100,000 contingency fund for seabirds and a $20,000 fund for bats. Under the terms set forth in the HCP, the value of these funds will increase at a rate of 2.5 percent per annum throughout the life of the project on any balance that remains unused,

In fulfillment of this obligation, KWP in February 2006 obtained a Letter of Credit (LOC) from HSH Nordbank in the amount of $414,000 naming the DLNR as beneficiary. The LOC amount is based on the base value of the contingency funds plus accrued interest. The LOC will expire on February 2010, and will be renewed in advance of that date in consultation with USFWS and DLNR.

IV. HAWAIIAN PETREL AND NEWELL'S SHEARWATER

1. **Nesting Colony Searches in the West Maui Mountains**

KWP began planning for investigations of breeding colonies of Hawaiian Petrels and Newell's Shearwaters in interior portions of the West Maui Mountains early in the implementation of the draft HCP. Early planning entailed assembling historical information from several sources that included records of audio detections and fledgling fallout patterns around West Maui. Most of these historic records were obtained from the DLNR Forestry and Wildlife Division office on Maui, National Park Service at Haleakala, and the West Maui Mountains Watershed Partnership (WMMWP) constituents (Maui Land and Pineapple Company/Pu`u Kukui Watershed Preserve, DLNR Natural Area Reserves System, and others). This information was used to compile a preliminary database of areas that would constitute our primary targets for field investigation. We interviewed observers directly to gather further detail that would help guide our field investigations. Initial, late-season surveys were conducted during the fall of 2005 in hopes of making positive detections of birds at a few of the more accessible sites. No detections were made in 2005. Appendix 3 provides a summary of the historical detection records we assembled, 2005 preliminary survey effort, and 2006 field investigations.

Our goals in 2006 were to obtain access to remote portions of West Maui to perform spring and summer visual and audio surveys that would narrow our search for colony locations, and if found, allow these areas to be quantified and mapped.

Before proceeding with field investigations it was necessary to obtain access authorization from various land owners. Land is divided among several principle owners in interior West Maui, including the State of Hawaii, Wailuku Water Company, Maui County Department of Water Supply, Maui Land and Pineapple, Makila Land Company, Kamehameha Schools, Kahomma Land LLC, and Kaanapali Land Company/The Nature Conservancy. Conservation initiatives are coordinated through the WMMWP Executive Board of Directors, which is composed of representatives from each of the owners. The approval process required that we submit written work proposals outlining our specific objectives and agree to basic rules and guidelines including signing release of liability waivers. The process was time-consuming but resulted in our being granted land access, albeit somewhat limited, to most sites we wished to visit in 2006. In addition, we agreed to work cooperatively with the WMMWP to share logistical costs and field support. This sharing of resources enabled us to achieve mutual goals and foster a healthy collaboration. In December, 2006 we submitted a report of our 2006 activities and a proposal for 2007 work to the WMMWP. We are now working to achieve a more flexible access agreement that will enable KWP to operate more independently throughout West Maui in 2007.

In 2006 we visited three remote sites in West Maui (Kahakuloa, lower Waihe`e Valley; Anakaluahine, near west rim of Honokahau Valley; and upper Waihe'e Valley) for a total of seven nights and mornings of observation. We made a single audio detection of a Hawaiian Petrel during evening observations and one visual of a seaward-bound petrel/shearwater target during early dawn observations at Kahakuloa. At Anakaluahine, while surveying along the western edge of Honokahau Valley, we observed one seaward-bound petrel/shearwater target just before dawn. We made two excursions deep into an area at the head of Waihe`e Valley. The first visit resulted in no detections, probably due to heavy rainfall and dense cloud cover at the time of the survey. The second visit occurred during more favorable weather for making observations. On the night of September 12, two petrel/shearwater targets were observed flying up the valley. In addition, because we routinely watch for bats during seabird observations, a single bat (presumably Hawaiian Hoary Bat) was also seen near the observation point. On the following night, cloud cover increased and there were no further positive observations made.

What we have learned through our first year of investigations is that evidence continues to suggest that petrels and/or shearwaters are using habitat in West Maui, presumably for nesting. Results of radar studies conducted by Cooper and Day (2003) on Maui in 2001 indicate significant movement of petrels and/or shearwaters into the interior of West Maui, with highest rates of movement between Kahakuloa and Waihe`e Valley and in 'Iao Valley. Our preliminary data support this for Kahakuloa and Waihe`e.

During helicopter access operations we also expanded our investigations to examine habitat in and around the regions we selected to perform surveys. Based on our assessments of habitat (elevation, topography and gradient, vegetation cover, and aspect) we believe there is suitable nesting habitat available for both these species in West Maui.

The 2007 survey effort will include a series of directed excursions beginning in late March or early April 2007. Early timing will afford us the highest likelihood of detecting

both species and mapping any colonies identified. If colonies are located, post-breeding investigations will be conducted as conditions allow. Post-breeding investigations may include: 1) determining the relative size of colonies, 2) mapping the colony boundaries and characterizing habitat, 3) evaluating basic demographic parameters such as number of burrows, number of apparent active/inactive burrows, apparent levels of natural and/or predator induced mortality, 4) identifying the potential for off-setting or mitigating threats inferred based on these observations, and 5) where appropriate, implementing mitigation measures in consultation with WMMWP, DLNR and USFWS.

2. On-Site Ornithological Radar and Enhanced Night Vision Surveys

We used ornithological radar and infra-red night vision to assess movement of Hawaiian Petrels and Newell's Shearwaters through the KWP project area during the summer and fall of 2006. We performed surveys from two sampling locations on the west side of the KWP site during early July, and from two sampling locations on the east side of the site in early November (Figure 2). The July sampling locations were chosen to correspond closely with those used by Day and Cooper (1999). Different locations were used in the fall in hopes of improving the overall radar coverage of the site. Summer sampling sites are referred to as Site 1 (upper) and Site 2 (lower); Fall sampling sites are designated Site 1 (lower) and Site 2 (upper).

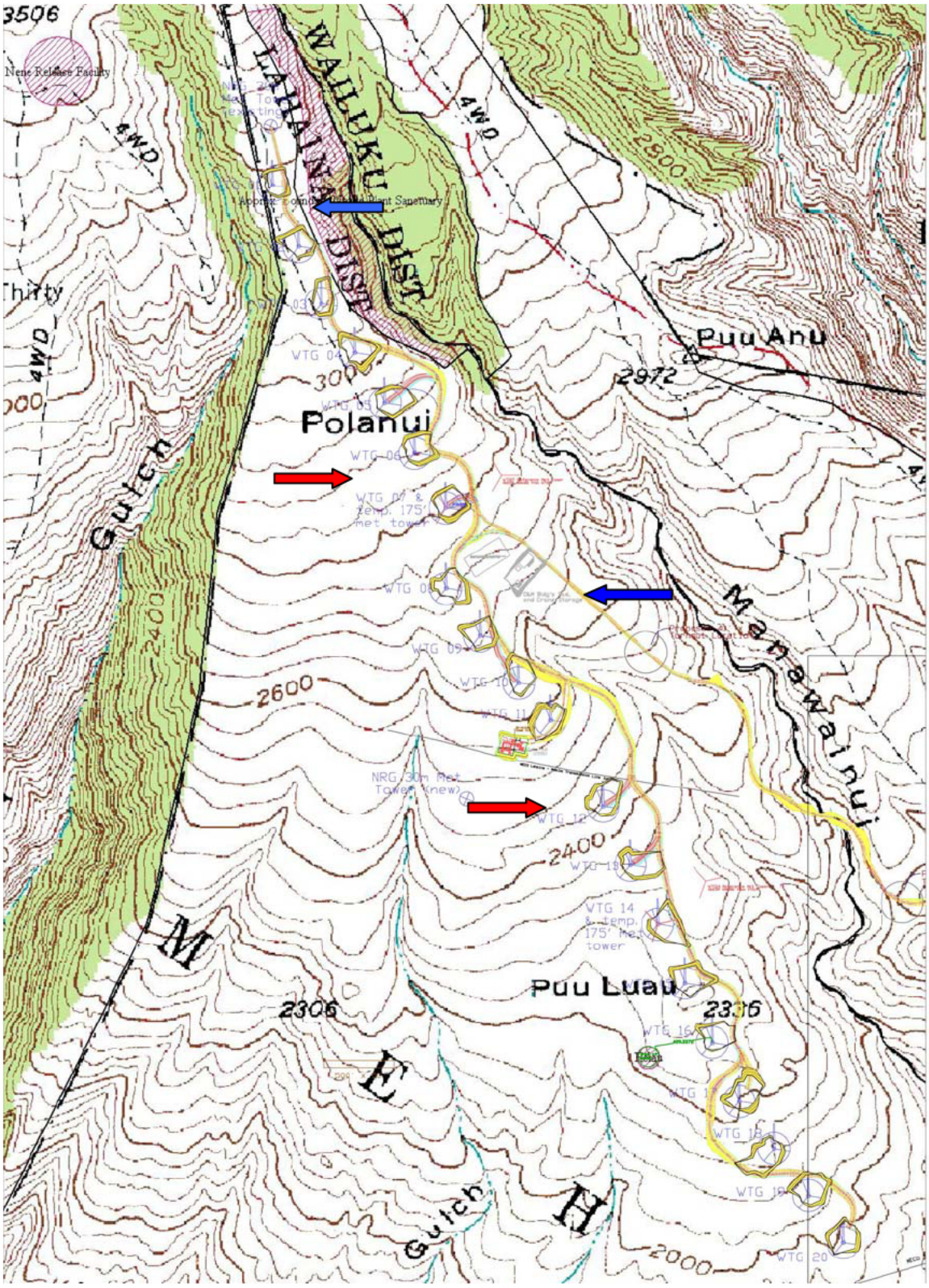

Figure 2. Sampling locations used for ornithological radar monitoring at the Kaheawa Pastures Wind Energy Facility, 2006. Arrows on the left (red) are for July, those on the right (blue), November.

Our goals during both sampling periods were to obtain estimates of seabird target movement rates during evening inland and pre-dawn seaward flight periods. In addition, we hoped to gain insights based on movement patterns observed on radar, and where practicable using visual techniques, to observe any changes in flight behavior, such as alterations in flight trajectory, that might be evident as seabird targets approached and passed the wind turbine layout.

Sampling methods followed closely those used by Cooper and Day (2004) and Day and Cooper (1999) in their previous radar studies at Kaheawa. Brian Cooper of ABR, Inc. was retained by KWP to procure and set-up the marine radar system, train KWP personnel, and to be available for consultation on an as-needed basis. Prior to conducting the surveys, KWP Senior Wildlife Biologist Greg Spencer spent five nights of training, orientation, and in-field practice with Mr. Cooper in the use of portable marine radar for performing studies of nocturnal bird movement. Greg also spent two nights with DLNR personnel making firsthand visual observations of Hawaiian Petrels at a newly rediscovered breeding colony on Lanai using night vision goggles. Sampling dates, times, and weather conditions are summarized below (Table 2).

TABLE 2. Sampling effort and weather conditions during spring/early summer and fall ornithological surveys at the Kaheawa Pastures Wind Energy Facility, West Maui, Hawaii, 2006.

Date	Site	Sampling Period	Weather Conditions and Comments
8 July	1	1900-2200	Strong, gusty trades; fog and heavy mist
9 July	1	0430-0630	Strong, gusty trades; fog and heavy mist
9July	1	1900-2200	Strong, gusty trades; heavy fog
10 July	1	0430-0630	Strong, gusty trades; fog/heavy mist/rain
10 July	1	1900-2200	Strong, gusty trades; cloudy, less precip.
11 July	1	0430-0630	Strong, gusty trades; cloudy, heavy mist
11 July	1	1930-2200	Strong, gusty trades, moderate cloud cover
12 July	2	0430-0500	Strong, gusty trades – heavy smoke cancelled survey/left site due to concerns over potential wildfire
12 July	2	1900-2200	Strong, gusty trades; periods of heavy mist
13 July	2	0430-0530	Strong, gusty trades; heavy, frequent mist
13 July	2	1900-2200	Strong, gusty trades; heavy, frequent mist
14 July	2	0430-0630	Strong, gusty trades; fog and heavy mist
14 July	2	1900-2030	Strong trades; fog; technical issues
16 July	2	1900-2200	Strong, gusty trades; fog and mist
5 November	2	1830-2100	Light, variable winds; partly cloudy
6 November	2	1830-2100	Light, variable winds; clear

TABLE 2 (Continued).

7 November	2	1830-2100	Moderate trades; partly cloudy, some drizzle
8 November	2	0430-0630	Moderate, gusty trades; partly cloudy
8 November	2	1830-2100	Moderate, gusty trades; cloudy, light rain
9 November	2	1830-2100	Light trades; partly cloudy
10 November	1	0430-0630	Calm; light to moderate cloud cover
10 November	1	1830-2100	Calm; light cloud cover, becoming clear
11 November	1	0430-0630	Calm; light cloud cover, becoming clear
11 November	1	1830-2100	Calm; mostly clear
12 November	1	0430-0630	Calm; mostly clear
12 November	1	1830-2100	Calm; mostly clear
13 November	1	0430-0630	Calm; mostly clear
13 November	1	1900-2130	Light SSW wind; cloudy becoming clear
14 November	1	0430-0530	Moderate W wind; rain developing

Previous radar studies at KWP suggested relatively low movement rates for petrel and shearwater-like targets during May and June sampling (Day and Cooper 1999), and fall sampling (Cooper and Day 2004). Surveys in 2006 likewise suggest movement rates were relatively low during summer and fall sampling periods.

Table 3 presents movement rates (targets per hour), where targets were recorded as petrel or shearwater-like based on the estimated target speed (measured on the radar screen) relative to wind speed (estimated on the ground and recorded at 60 m above ground from adjacent meteorological tower instruments), and flight behavior.

TABLE 3. Estimated movement rates of petrels and shearwaters identified on ornithological radar at the Kaheawa Pastures Wind Energy Facility, West Maui, Hawaii, 2006.

Site	Date	Evening	Morning	Daily Average (n sampling units[1])
1 (Summer)	8 July	4.4 (6)	----	4.4 (6)
	9 July	3.2 (6)	1.6 (3)	1.3 (9)
	10 July	7.2 (6)	----	7.2 (6)
	11 July	3.8 (5)	1.8 (4)	1.5 (9)
	Total	4.7 (23)	1.7 (7)	3.6 (30)
2 (Summer)	12 July	1.6 (6)	----	1.6 (6)
	13 July	0 (2)	0.5 (2)	0.3 (4)
	14 July	0 (3)	0 (4)	0 (6)

TABLE 3 (Continued).

	16 July	0 (6)	0 (4)	0 (10)
	Total	0.4 (17)	0.2 (10)	0.5 (26)
1 (Fall)	10 November	0 (5)	0 (4)	0 (9)
	11 November	0 (5)	0 (4)	0 (9)
	12 November	0 (5)	0 (4)	0 (9)
	13 November	0 (5)	0 (4)	0 (9)
	14 November	----	0 (2)	0 (2)
	Total	0 (20)	0 (18)	0 (38)
2 (Fall)	5 November	0 (5)	----	0 (5)
	6 November	0.5 (5)	----	0.5 (5)
	7 November	1.0 (5)	----	1.0 (5)
	8 November	0 (5)	1.8 (4)	0.5 (9)
	9 November	0 (5)	----	0 (5)
	Total	0.3 (25)	1.8 (4)	0.4 (29)

[1] A sampling unit consisted of a 25 minute radar observation period. Radar observations periods were separated by 5 minutes breaks to record weather conditions.

During summer sampling, average daily movement rates varied between 1.3-7.2 targets per hour and averaged 3.6 per hour overall at Site 1. Movement ranged between 0 and 1.6 targets per hour at Site 2 with an average rate overall of 0.5 per hour. Day and Cooper (1999) reported average overall movement rates during late spring/early summer at Site 1 to be 1.7 targets per hour, and 0.8 targets per hour at Site 2. Our estimated rates of daily movement measured at Site 1 during summer are twice the values reported by Day and Cooper (1999). Weather was one variable that was significantly different when comparing the two sampling periods. Unlike conditions reported by Day and Cooper in 1999, during 2006 trade winds were strong (essentially gale force) and accompanied by significant precipitation, compromising sampling on several occasions, and possibly affecting movements of shearwaters and petrels. In addition, our summer sampling effort in 2006 did not commence until nearly 5 weeks later in the seabird breeding season than the Day and Cooper (1999) study. Flight direction for all sampling periods and locations during summer were seaward (average 215^{o}, n=55), corresponding well with the results reported by Day and Cooper (181^{o} overall, 1999).

During fall, we observed a total of 6 targets on radar that fit our shearwater/petrel criteria. All six targets were observed during three sequential sampling days in early November. Three were observed during evening sampling and three were observed during early morning. Five of the targets were moving in a southerly direction (range 180^{o}-220^{o}) while one target observed during evening sampling moved through on a 265^{o}, or westerly heading. Cooper and Day (2004) reported higher numbers of targets overall (37), 92% of which traveled seaward (night and morning combined). Contrary to our observations, they also observed targets at both sampling sites (14 at Upper Site, 23 at Lower Site). Fall radar sampling at KWP in 2006 was performed nearly three weeks later in the seabird fledging season than the Cooper and Day (2004) studies, again making direct

comparisons difficult but suggesting variability in movement rates as the season progresses.

Precipitation does interfere with the radar signal and contributed to several sessions being interrupted or lost altogether. During the early July sampling period, inclement weather inhibited the use of night vision techniques for species identification and flight altitude estimates. Even with improved weather and visibility during the November sampling period, no positive visual target verifications were made. Although the results do not necessarily match the prior work of Day and Cooper (1999) and Cooper and Day (2004) closely, all studies entailed relatively small sample sizes. All of the surveys generally indicated low movement rates, and mean target movement in a seaward direction, regardless of season or time of day.

We made observations of seabird targets displayed on the radar screen for purposes of estimating flight speed, flight direction, and behavior. In addition, we carefully observed flight trajectory of individual targets as they passed near or crossed the wind turbine layout. We noted that on a few occasions seabird targets that approached the turbine layout from a semi-perpendicular or angular direction in straight line flight appeared to alter their course in a manner that suggested avoidance. This apparent alteration in flight trajectory can be characterized as a slight shift from direct straight line flight as a target approaches the turbines to a sudden shift in direction which appeared to take the target through two adjacent turbines followed by an apparent resumption of straight line flight as the target cleared the turbines. Although preliminary, our observations suggest that shearwaters and petrels may be capable of detecting the turbine structures and altering their flight behavior to avoid obstacles in their flight paths. We hope to explore methods that may enable us to capture visual data sequences using ornithological radar in an effort to better document interaction and avoidance behavior exhibited by seabirds at Kaheawa.

3. **Seabird Contingency Fund**

The $100,000 contingency fund for seabird mitigation is one of three such funds prescribed under the HCP, which together total $384,000. The other two funds include a $264,000 contingency fund for Nene and a $20,000 fund for bats. Under the terms set forth in the HCP, the value of these funds will increase at a rate of 2.5 percent per annum throughout the life of the project on any balance that remains unused,

In fulfillment of this obligation, KWP in February 2006 obtained a Letter of Credit (LOC) from HSH Nordbank in the amount of $414,000 naming the DLNR as beneficiary. The LOC amount is based on the base value of the contingency funds plus accrued interest. The LOC will expire on February 2010, and will be renewed in advance of that date in consultation with USFWS and DLNR.

V. HAWAIIAN HOARY BATS

1. Bat Observations during Petrel and Shearwater Colony Searches

Attention was directed at documenting incidental observations of Hawaiian Hoary Bats during the seabird colony search effort. Only one bat was detected visually on the evening of September 12, 2006 in the upper portion of Waihe'e Valley.

2. Monthly On-Site Observational Surveys

Surveys to look at occurrence of Hawaiian Hoary Bats and to document their interaction with turbines and other structures at KWP began in June, 2006, and have followed protocols outlined in the HCP. Night vision enhanced surveys occur for 6 hours per night on two consecutive nights each month using a 2 million candle-power IR spotlight and night vision goggles. Surveys usually begin near sunset and continue for 6 hours (25 minute survey sessions separated by 5 minute breaks to collect weather data).

The geographic scope of the surveys has evolved somewhat based on initial results. We first began performing surveys solely in the vicinity of the wind turbine structures. This was of particular interest, since bats within the site would presumably be at greatest risk, and no previous surveys had been conducted at the site. However, no bats were ever observed. In the interest of understanding whether bats might be associated with other nearby habitats, the scope of the surveys has been extended to include some of the adjacent gulch areas. These areas provide more diverse vegetation cover, and are somewhat sheltered, which might favor airborne prey and afford a greater bat detection probability. We are presently splitting our survey effort between the immediate wind turbine site and adjacent gulches.

Our observations indicate that there are ample quantities of airborne insect prey that appear to emerge from the gulches during the nighttime survey periods. However, thus far no positive visual detections of bats have been made.

3. Funding Allocation for Hawaiian Hoary Bat Research

KWP has been in regular contact with DLNR since summer 2005 regarding the HCP requirement for providing a $20,000 payment in support of Hawaiian Hoary Bat research. Until recently DLNR has been uncertain as to how the funds should be paid. In October 2006 DLNR indicated that the payment could be made to the state's Endangered Species Trust Fund. Payment was made by KWP in December 2006.

4. Hawaiian Hoary Bat Contingency Fund

The $20,000 contingency fund for Hawaiian Hoary Bat mitigation is one of three such funds prescribed under the HCP, which together total $384,000. The other two funds

include a $264,000 contingency fund for Nene and a $100,000 fund for seabirds. Under the terms set forth in the HCP, the value of these funds will increase at a rate of 2.5 percent per annum throughout the life of the project on any balance that remains unused,

In fulfillment of this obligation, KWP in February 2006 obtained a Letter of Credit (LOC) from HSH Nordbank in the amount of $414,000 naming the DLNR as beneficiary. The LOC amount is based on the base value of the contingency funds plus accrued interest. The LOC will expire on February 2010, and will be renewed in advance of that date in consultation with USFWS and DLNR.

VI. WILDLIFE OBSERVATION AND EDUCTION PROGRAM (WEOP)

1. WEOP Protocols and Personnel Orientations: Pre-Operational

One of the first measures KWP implemented under the draft HCP was the Wildlife Observation and Educational Program (WEOP) for on-site construction and operations personnel. The first step in implementing this program was a training session for UPC and contractor supervisors and senior staff, held at the Kahili Golf Club on August 25, 2005. The training session included presentations by John Medeiros (DOFAW Wildlife Biologist), Eric Nishibayashi (Biological Consultant), and Dave Cowan (UPC Vice President of Environmental Affairs).

Regular training sessions were also conducted on-site throughout the construction period by UPC Senior Wildlife Biologist Greg Spencer. At its peak, construction and contract personnel numbered up to 40-50 active participants working on site. This program was intended to provide a comprehensive orientation for all staff and contract personnel present on site about the wildlife resources that occur at KWP, with an emphasis on HCP covered species. The orientation included a verbal presentation by the KWP Senior Wildlife Biologist on our responsibilities under the HCP and what is expected of all personnel while working on the project. It also required that prior to entering the job site for the first time, all personnel would view a short video presentation that describes the natural history, ecology, management initiatives, and laws that protect Nene (and other species) under the U.S. and State of Hawai`i Endangered Species Acts. Each vehicle that would be used on site was also equipped with a laminated reference sheet that explains the wildlife species most likely to be encountered on site with specific instructions on how to respond in the event of encounters with HCP covered species (see attached Wildlife Orientation for Kaheawa Wind Farm Staff).

In addition to the initial WEOP orientation, regular updates were given to staff and contractors in writing and in formal group sessions. We performed full participant wildlife orientations on an approximately monthly basis and when special circumstances dictated. These updates provided information on where birds were regularly being seen, and observed changes that might require additional awareness on the part of personnel engaged in construction or other activities. Most of the emphasis was placed on Nene due to the species' regular presence on site, and greater potential for interaction with personnel. Providing these updates was enormously effective at fostering awareness, and was also useful in tracking the movement and distribution of Nene on site.

2. WEOP Protocols and Personnel Orientations: Operational

The WEOP protocols extend into the operational phase of the project in much the same fashion as they proceeded during pre-operations. KWP Operations and Maintenance staff are required to inform the Senior Wildlife Biologist in advance of new personnel arriving so that adequate wildlife orientations can be provided. A Wildlife Observations Logbook is posted on site and enables all staff and contract personnel to enter the details of their observations of HCP covered wildlife. The logbook contains fields for entering data that include:

1) date and time of observations,
2) species and number of individuals,
3) location,
4) proximity to wind turbine(s) and other structures,
5) apparent behavior,
6) if in flight, estimated height above ground in meters,
7) flight direction, and
8) pertinent comments.

All personnel regularly performing activities on site (including short-term personnel) receive a thorough orientation similar to that performed during the pre-operational phase of the project. They are also given an orientation to the Wildlife Observation Logbook with instructions on how to record observations. The Logbook has proven an effective means of obtaining observations that might otherwise have not been possible relying on verbal communication alone. In particular, this system has improved our ability to track the movements of Nene on site, even when environmental staff can not directly observe their presence. Many of the operations and maintenance personnel and contractors have had few opportunities to view species like Nene in the wild, thus this program serves to promote a sense of responsibility for the resources, which has been a great asset in our efforts to care for the well-being of HCP covered species throughout the project. Since the logbook went into full-time use last summer we have logged over 40 independent observations by operations and contract personnel at KWP (see attached example).

VII. BOTANICAL RESOURCES

KWP commissioned Robert Hobdy to provide an assessment of risks to sensitive or federally listed endangered plant species that might exist within an area of overlap between wind turbine Fatality Search Plots (WTG 1-4) and the adjacent Manawainui Gulch State Plant Sanctuary and Papalaua Gulch (Appendix 3). Mr. Hobdy is intimately familiar with these areas, having been one of the principal botanists who performed botanical community assessments of these gulches and adjacent landscape in the early years of the plant sanctuary's inception. KWP is required to perform regular searches (on foot) of 180x200m rectangular plots centered on each of the wind turbines as part of the fatality monitoring program. However, portions of the plots surrounding WTG 1-4 overlap with both gulches where historical records indicate that specimens of endangered native plants are present. The principle goal of this survey was to determine whether any

federally listed plant species or species of significant concern might occur within the overlapping area of these search plots.

Mr. Hobdy identified several specimens of federally listed plants outside but proximate to the search plot boundaries in both Manawainui and Papalaua Gulches. Though no specimens of these listed species occur in the plots themselves, Mr. Hobdy recommended that foot searches not be performed in some of these areas due to the sensitive nature of the surrounding plant communities, coupled with the steep and prohibitive terrain. So far, searches of these overlap areas are being performed by scanning the overlap area with binoculars from vantage points outside the gulches themselves in order to avoid undue adverse impacts.

VIII. AVIAN AND BAT FATALITY MONITORING

1. Carcass Removal Trials

Carcass Removal Trials have been performed on four occasions since November, 2005. The results of these trials suggest that on average 64% of avian carcasses remain present and nearly intact by day 7 of the trial, and an average of 38% of carcasses remain visible to observers by day 14. The first trial was initiated in November, 2005 and included 15 carcasses of three species (Common fowl, Common myna, and Java finch) and lasted 30 days. The next three trials (April, June, and October 2006) included eight carcasses of two species (House sparrow and Spotted dove) and lasted 14 days each. Table 4 summarizes removal rates for these four trials.

TABLE 4. Removal rates for avian carcasses used in Carcass Removal Trials at the Kaheawa Pastures Wind Energy Facility, West Maui, Hawaii, 2005-2006.

Trial	Day	Specimens Present/Visible	Removal Rate (%)
1	1	14	7
	3	13	14
	5	13	14
	7	6	60
	10	6	60
	14	4	73
2	1	6	0
	3	5	17
	5	4	33
	7	4	33
	10	4	33
	14	3	50
3	1	8	0
	3	7	12
	5	6	25
	7	6	25

TABLE 4(Continued).

	10	6	25
	14	3	64
4	1	8	0
	3	7	13
	5	7	13
	7	6	25
	10	6	25
	14	3	63

Trial 1, November 2005; Trial 2, April 2006; Trial 3, June 2006; Trial 4, October 2006

Regular searches of the plots occur weekly; on average each plot receives a thorough search every seven days. Therefore, one of the most important values to consider when evaluating the results of the carcass removal trials are the percentage of avian carcasses that remain present and visible at day seven. In addition, during October-November and May-June, searches are required to be performed twice per week wherein each plot receives a thorough search every 3.5 days. With the exception of Trial 1, which had the highest number of carcasses placed on the site over the longest duration, 67% of carcasses remained visible to human observers by day seven of the trials. In fact, for the last three trials no greater than 64% removal rate was observed at 14 days.

While these results are informative, we believe that using seabird surrogates that more closely resemble both Newell's Shearwaters and Hawaiian Petrels would be preferable. Efforts are in the works to obtain the necessary licenses and carcasses in cooperation with state and federal agency staff.

2. **Searcher Efficiency Studies (SEEF)**

Searcher Efficiency studies (SEEF) were first initiated in July, 2006. We used non-listed (ESA) and non-protected (MBTA) spotted doves as surrogates, obtained from the USDA Wildlife Services division in Kahului, Maui for all trials. Most trials occurred in conjunction with regular plot searches. A typical SEEF requires an observer to place two carcasses on the ground on a search plot in advance of the start of a standard search effort. The location of the carcasses is loaded on the GPS for subsequent retrieval and/or verification of location following the trial. The searcher is not told where the carcasses will be placed, and in most cases is unaware that a SEEF exercise is being performed.

Eight SEEF trials performed between July 17 and November 16, 2006, resulting in an overall efficiency rate of 62.5%. Sixteen (16) carcasses were used to perform the trials. The HCP prescribes that SEEF trials should be performed at least quarterly during the first year of intensive monitoring, although additional trials may be performed to increase statistical power and reduce variance. The SEEF trials we have thus far performed provide preliminary estimates of searcher efficiency. Using surrogates that more closely resemble HCP covered species should reduce some bias and may better reflect overall

efficiencies. For future trials it is our intention to incorporate suitable surrogates and conduct additional trials over a broader range of environmental conditions.

3. Intensive Monitoring Surveys for Downed Wildlife

Intensive monitoring for downed wildlife at KWP has been a significant labor component of HCP implementation since operations began in early June. Systematic sweeps of the areas around standing structures occurred regularly prior to any turbines becoming operational. In the weeks preceding operations we began establishing fatality monitoring plots according to the layouts prescribed in the HCP. Each plot consists of a 180x180 square centered on the tower base, with an additional 180x20m area added to the downwind side. Rectangular in shape, the plots measure 180x200 meters and are situated in a NE-SW orientation. We established these plot boundaries using GIS files and a Trimble GPS Pathfinder GeoXT handheld receiver and compass. Plot boundaries were marked using steel fence posts and labeled for reference.

Transects were established in a manner that would achieve the prescribed distance between transects (6-8 meters) while also enabling searches to be performed efficiently. To accomplish the latter, we laid transects out parallel to each other using wooden laths along the natural contours of the landscape. This layout scheme aids the searcher in maintaining position along the transect and enables the most coverage to be obtained while providing stability and relative ease of movement during searches.

Systematic foot searches began as part of the intensive monitoring protocol prescribed in the HCP, on June 5th, within days of the first operational rotation of turbine components. These searches have continued on a regular basis and amount to 534 man hours of search effort. Searches include the entire wind turbine search plot, plots around the adjacent meteorological towers, and the substation facility. We have found that to be effective and maintain alertness and stamina, the average time commitment for a single searcher is about 4 hours, sometimes more. Search effort has been within the range acceptable by compliance standards (once per week), though some deficit occurred during the high-intensity search period coinciding with the fledging season for Hawaiian Petrels and Newell's Shearwaters, October-November (average 1.13 site-wide searches per week). We intend to increase our coverage in the future during these high risk periods as required. A full record of search effort can be found in Appendix 1.

No downed wildlife or fatalities have so far been observed at KWP. Carcass Trials and Searcher Efficiency Studies have suggested that our search frequency is adequate to discover most avian fatalities within one week of deposition. Searcher Efficiency Studies and Carcass Trials alike, to date have used only terrestrial avian surrogates to examine visibility and persistence of carcasses. We will soon begin using carcasses of the Wedge-tailed Shearwater, a close relative of the Newell's Shearwater, to increase the validity of our carcass removal and searcher efficiency trials.

IX. TOPICS FOR DISCUSSION

Successful implementation of the HCP provides a wide range of avoidance, minimization, and mitigation measures that are intended to result in a net conservation benefit for the four covered species. During the first year of implementation, we have accomplished many of the prescribed objectives. Some logistical challenges have arisen that have required that we make certain adaptations. For instance, a wildfire consumed roughly 4,000 acres of vegetation across a significant portion of land adjacent to and within the KWP facility over a two week period in September. As a consequence, the burned areas were unsafe for foot travel during September 6-20. Most of the search plot transect markers were destroyed and had to be replaced. The landscape was altered and our surveys and monitoring had to adapt accordingly.

Though relatively intact native botanical elements occur within certain portions of KWP, the majority of the site is comprised almost entirely of non-native vegetation that forms dense beds and thick stands. In some locations these are nearly impenetrable. The nature of the molasses grass cover over large portions of the site might affect the visibility of downed wildlife. We invite discussion that addresses how additional site management or monitoring methods might lessen these concerns.

Results of the botanical survey that was performed in the WTG 1-4 plant sanctuary overlap areas determined that no ESA listed plant species occur inside the search plots. However, the report recommended that due to the intact native elements and condition of the habitat in the two adjacent gulches, foot searches should be replaced with another means of obtaining acceptable levels of fatality monitoring. Thus far, we have used binoculars to scan portions of the overlap areas from the edges of both gulches, but this has not been sanctioned as a fully acceptable means of compliance and should receive further attention.

X. LITERATURE CITED

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Appendix 1. Fatality and Downed Wildlife Monitoring Log
Standard Reporting Record
Kaheawa Pastures Wind Energy Facility/Kaheawa Wind Power, LLC 2006

Observer	Date	Search Plot/Area	Start Time	End Time	Man Hours
I. Bordenave	6/5/2006	WTG 1-5	9:00	15:00	3.00
I. Bordenave	6/6/2006	WTG 6-12	9:00	16:00	6.00
I. Bordenave	6/8/2006	WTG 13-17	10:00	14:00	4.00
I. Bordenave	6/9/2006	WTG 18-20	12:00	15:30	3.50
I. Bordenave	6/13/2006	WTG 1-4	9:00	13:00	4.00
I. Bordenave	6/14/2006	WTG 5-8	12:00	16:00	4.00
I. Bordenave	6/15/2006	WTG 6-12	8:30	15:00	6.50
I. Bordenave	6/16/2006	WTG 13-18	8:00	15:00	7.00
G. Spencer and I. Bordenave	6/20/2006	WTG 19-20	10:30	13:30	6.00
G. Spencer and I. Bordenave	6/21/2006	WTG 1-4	9:00	14:00	10.00
G. Spencer and I. Bordenave	6/22/2006	WTG 5-7	14:00	17:00	6.00
G. Spencer and I. Bordenave	6/23/2006	WTG 8-12	11:00	15:00	8.00
G. Spencer and I. Bordenave	6/24/2006	WTG 13-16	10:00	15:00	10.00
G. Spencer and I. Bordenave	6/28/2006	WTG 17-20	9:00	14:30	11.00
G. Spencer and I. Bordenave	7/5/2006	WTG 1-3	12:00	15:00	6.00
G. Spencer and I. Bordenave	7/6/2006	WTG 4-8	11:00	15:00	8.00
G. Spencer and I. Bordenave	7/7/2006	WTG 9-10	11:00	13:30	5.00
G. Spencer and I. Bordenave	7/10/2006	WTG 11-14	11:00	15:00	8.00
G. Spencer and I. Bordenave	7/11/2006	WTG 15-18	11:00	14:30	7.00
G. Spencer and I. Bordenave	7/12/2006	WTG 19-20	12:00	15:00	6.00
G. Spencer and I. Bordenave	7/17/2006	WTG 8-12	9:00	14:30	11.00
G. Spencer and I. Bordenave	7/19/2006	WTG 13-17	12:00	16:45	9.50
G. Spencer and I. Bordenave	7/20/2006	WTG 19-20	12:30	15:00	5.00
G. Spencer and I. Bordenave	7/21/2006	WTG 1-4	11:00	15:00	8.00
G. Spencer and I. Bordenave	7/24/2006	WTG 5-7	9:00	13:30	9.00
G. Spencer and I. Bordenave	7/27/2006	WTG 1-5	10:30	16:00	11.00
G. Spencer and I. Bordenave	7/28/2006	WTG 6-9	9:30	14:00	9.00
G. Spencer and I. Bordenave	7/31/2006	WTG 10-14	10:00	14:30	9.00
G. Spencer and I. Bordenave	8/1/2006	WTG 15-18	13:00	16:45	7.50
G. Spencer and I. Bordenave	8/2/2006	WTG 19-20	15:00	17:00	4.00
G. Spencer and I. Bordenave	8/7/2006	WTG 1-4	9:00	14:30	11.00
G. Spencer and I. Bordenave	8/8/2006	WTG 5-9	10:30	13:30	6.00
G. Spencer and I. Bordenave	8/10/2006	WTG 10-15	10:00	15:00	10.00
G. Spencer and I. Bordenave	8/11/2006	WTG 16-20	8:30	12:00	7.00
G. Spencer	8/14/2006	WTG 1-4	12:00	16:30	4.50
G. Spencer	8/15/2006	WTG 5-7	12:00	15:00	3.00
G. Spencer	8/18/2006	WTG 8-12	9:30	14:00	4.50
G. Spencer	8/19/2006	WTG 13-15	12:30	15:00	2.50
G. Spencer	8/21/2006	WTG 16-17	11:00	15:30	4.50
G. Spencer and I. Bordenave	8/23/2006	WTG 18-19	9:30	12:30	6.00
I. Bordenave	8/24/2006	WTG 20-2	13:30	15:30	2.00
I. Bordenave	8/31/2006	WTG 3-5	12:00	14:00	2.00
I. Bordenave	9/5/2006	WTG 6-8	11:00	13:30	2.50
Wildfire prohibits safe monitoring beginning 9/6 and lasting through 9/20					
I. Bordenave	9/22/2006	WTG 7-9	10:30	14:00	3.50
I. Bordenave	9/25/2006	WTG 9-11	13:45	16:00	2.25
I. Bordenave	9/26/2006	WTG 12-14	13:30	15:30	2.00

Observer	Date	Search Plot/Area	Start Time	End Time	Man Hours
I. Bordenave	9/27/2006	WTG 15-18	12:30	15:00	2.50
I. Bordenave	9/29/2006	WTG 19-4	13:00	16:30	3.50
I. Bordenave	9/30/2006	WTG 5-8	14:00	16:00	2.00
I. Bordenave and G. Spencer	10/2/2006	WTG 1-5	9:00	14:30	11.00
I. Bordenave and G. Spencer	10/3/2006	WTG 6-12	8:30	14:00	11.00
I. Bordenave and G. Spencer	10/4/2006	WTG 13-18	12:00	16:00	8.00
I. Bordenave	10/6/2006	WTG 19-20	9:30	11:15	1.75
G. Spencer	10/6/2006	WTG 4-9	9:30	13:00	3.50
I. Bordenave	10/6/2006	WTG 1-3	12:00	14:00	2.00
I. Bordenave	10/10/2006	WTG 17-20	11:00	14:30	3.50
I. Bordenave and G. Spencer	10/11/2006	WTG 10-16	10:00	14:30	9.00
I. Bordenave and G. Spencer	10/12/2006	WTG 5-9	8:30	13:00	9.00
I. Bordenave	10/13/2006	WTG 1-4	12:00	16:00	4.00
I. Bordenave	10/16/2006	WTG 8-10	11:30	14:00	2.50
I. Bordenave and G. Spencer	10/17/2006	WTG 11-16	10:00	15:30	11.00
I. Bordenave and G. Spencer	10/18/2006	WTG 17-20	9:30	12:00	5.00
I. Bordenave and G. Spencer	10/18/2006	WTG 1-2	13:30	14:00	1.00
I. Bordenave	10/20/2006	WTG 3-7	10:30	14:30	4.00
G. Spencer	10/21/2006	WTG 8-11	12:00	15:30	3.50
I. Bordenave and G. Spencer	10/22/2006	WTG 12-17	9:00	15:00	6.00
I. Bordenave and G. Spencer	10/24/2006	WTG 18-20	11:00	13:45	5.50
I. Bordenave and G. Spencer	10/24/2006	WTG 5-7	14:00	16:00	4.00
I. Bordenave	10/25/2006	WTG 1-4	12:00	15:00	3.00
I. Bordenave	10/26/2006	WTG 8-11	11:30	14:00	2.50
I. Bordenave and G. Spencer	10/30/2006	WTG 16-20	9:30	12:45	6.50
I. Bordenave	10/31/2006	WTG 13-15	10:00	12:30	2.50
I. Bordenave and G. Spencer	11/1/2006	WTG 8-14	9:00	15:30	13.00
I. Bordenave and G. Spencer	11/3/2006	WTG 1-5	9:00	13:45	9.50
I. Bordenave and G. Spencer	11/6/2006	WTG 6-10	12:00	16:15	8.50
I. Bordenave and G. Spencer	11/7/2006	WTG 11-14	8:30	12:00	7.00
I. Bordenave and G. Spencer	11/9/2006	WTG 15-16	7:30	9:00	3.00
I. Bordenave	11/10/2006	WTG 17-19	10:30	14:00	3.50
G. Spencer and I. Bordenave	11/13/2006	WTG 20-3	9:00	12:30	7.00
I. Bordenave	11/14/2006	WTG 4-7	9:30	13:00	3.50
I. Bordenave	11/15/2006	WTG 8-13	10:00	14:00	4.00
G. Spencer and I. Bordenave	11/16/2006	WTG 14-17	12:00	16:00	8.00
I. Bordenave	11/17/2006	WTG 18-1	12:30	16:00	3.50
I. Bordenave	11/20/2006	WTG 2-5	11:00	14:30	3.50
I. Bordenave	11/21/2006	WTG 6-10	8:30	13:00	4.50
G. Spencer	11/22/2006	WTG 11-15	9:30	12:30	3.00
I. Bordenave and G. Spencer	11/27/2006	WTG 16-20	12:00	16:00	8.00
I. Bordenave	11/28/2006	WTG 1-4	9:30	12:30	3.00
I. Bordenave	11/29/2006	WTG 5-10	11:00	15:15	4.25
I. Bordenave	11/30/2006	WTG 11-13	10:00	14:00	4.00
I. Bordenave	12/1/2006	WTG 14-16	14:00	17:00	3.00
I. Bordenave	12/4/2006	WTG 17-20	12:30	16:00	3.50
I. Bordenave	12/5/2006	WTG 1-3	13:30	15:30	2.00
I. Bordenave	12/6/2006	WTG 4-8	11:00	1:45	2.75
I. Bordenave	12/7/2006	WTG 9-13	9:30	14:30	5.00
I. Bordenave	12/8/2006	WTG 14-18	11:00	15:00	4.00

Appendix 2. Results of Nene Observations and Interactions, Systematic Survey Effort, Kaheawa Wind Energy, 2006

Date	Begin	End	Obs Time	No. of Birds	Flight Dir	Flt Alt (magl)	Obs Location	Obs	Behavior	Comments
5-Jun	16:00	17:00	16:10	6	E	10	adj to WTG 9	IB, GS	F	Flew in from W and landed along jeep road
6-Jun	7:00	8:00	7:30	2	N	30	adj to WTG 14	IB	E	Flew upslope above Pu'u
7-Jun	14:00	15:00	14:05	7	S		adj to WTG 19	IB	E	Flying about rotor height, SW of WTG 20
9-Jun	16:00	17:00	16:30	7	NE	80	between WTG 15-16	IB	G	Birds flew between and over turbines
12-Jun	6:45	7:45	7:00	4	N		adj to Manawainui	IB	E	Flew directly up the gulch and out of sight
13-Jun	7:00	8:00	7:30	5	NW	100	adj to Manawainui	IB	E	Flew in from unnamed Pu'u and across N portion of gulch
20-Jun	13:30	14:30						IB		No birds observed
18-Jul	15:00	16:00	15:15	4	NW	100	adj to WTG 2	IB	E	Distance about 0.5 mi W of WTG 2, landed eastern Hanaula
18-Jul	15:00	16:00	15:20	3		50	adj to WTG 5	IB	A	Flew in from Pu'u and crossed through WTG 3-4 to land eastern Hanaula
19-Jul	11:00	12:00	11:33	6	NNW	100	adj to WTG 1	IB, GS	E	Flew adj to Manawainui and turned N of turbine to NW
21-Jul	7:00	8:00	7:45	7	NE	50	WTG 1-2	IB	C	Flock of 7; 4 split off and pass through turbines (WTG 1-2) and go toward Hanaula; other 3 Hanaula bound
28-Jul	8:30	9:30	8:40	2	E	70	adj to WTG-1	IB, GS	E	North of site, eastbound
30-Jul	8:00	9:00						IB		No birds observed
8-Aug	7:30	8:30	7:57	6	WSW	180	Mid-string	GS	B	Flew toward mid-string and within 0.25 mi turned and continued south
8-Aug	7:30	8:30					adj to WTG 2-3	IB		No birds observed
11-Aug	12:00	13:00					adj to WTG 17	IB, GS		No birds observed
20-Aug	8:30	9:30		2	E	100	adj to WTG 12	IB	E	Flew east, well below WTG 20
29-Aug	16:30	17:30					adj to WTG 8	IB		No birds observed
31-Aug	11:00	12:00					adj to WTG 5	IB		No birds observed
4-Sep	9:00	10:00	9:10	1	E	100	adj to WTG 9	IB	G	Transiting towards pastures to east, well above turbines, over WTG 2-3 vicinity
4-Sep	14:00	15:00					adj to WTG 2-3	IB		No birds observed
21-Sep	7:00	8:00					mid-string	IB		No birds observed
23-Sep	10:00	11:00					adj to WTG 17	IB		No birds observed
26-Sep	12:30	13:30					adj to WTG 3	IB		No birds observed
4-Oct	7:00	8:00								No birds observed
4-Oct	15:00	16:00	15:45	2	W	40	near O&M	GS	A	Flew straight between WTG 7-8
5-Oct	9:00	10:00					near O&M	GS		No birds observed
5-Oct	11:00	12:30					adj to WTG 5	IB		No birds observed
10-Oct	17:00	18:30	17:35	2	S	30	adj to WTG 19-20	IB	E	150 m W of turbines
10-Oct	17:00	18:00	17:40	2	W	70	adj to WTG 1	IB, GS	F	Passing over and between turbines (WTG 2-3) max rotor height
19-Oct	13:00	14:00	13:00	2	W	30	adj to WTG 20	IB, GS	E	Vocal, passed well below turbine WTG 20 at powerline height
19-Oct	13:00	14:00	13:10	2	E		edge of Manawainui	GS	E	Lower gulch past Pu'u and beyond
19-Oct	13:00	14:00	13:32	1	NW	4	WTG 6-7	IB	A	Flew in low from Manawainui and between turbines toward Hanaula
24-Oct	7:15	8:15					mid-string	IB		No birds observed

Date	Begin	End	Obs Time	No. of Birds	Flight Dir	Flt Alt (magl)	Obs Location	Obs	Behavior	Comments
5-Nov	8:00	9:30						IB		No birds observed
10-Nov	16:00	17:30	17:25		W	80	adj to WTG 5	GS	E	Single bird flew west well above WTG 1.
15-Nov	13:00	14:00					mid-string	IB		No birds observed
15-Nov	17:00	18:00					near sub-station	GS		No birds observed
22-Nov	16:00	17:00	16:55	2	NW	>100	adj to WTG 1	IB, GS	E	Well north of the site
23-Nov	8:00	9:00					mid-string	IB		No birds observed
23-Nov	8:00	9:00	8:05	1	N	80	E of Manawainui	GS		
29-Nov	7:30	8:30					adj to WTG 2	IB		No birds observed
30-Nov	10:00	11:00					adj to WTG 7	IB		No birds observed
4-Dec	17:00	18:00					near sub-station	IB		No birds observed
6-Dec	12:00	13:00					adj to WTG 19	IB		No birds observed
8-Dec	08:00	09:30					adj to WTG 14	GS, IB		No birds observed

Behavior Codes: A = staight line flight between turbines , B = changed course and went around turbines
C = flock split, some pass between turbines, D = Flew parallel to turbines
E = Passed well outside site and away from turbines, F = Flew in and landed
G = Flew over turbines

Observers: IB (Ian Bordenave), GS (Greg Spencer)

APPENDIX 3

Historical records of Hawaiian Petrel and Newell's Shearwater audio and visual detections, West Maui, Hawaii. Kaheawa Pastures Wind Energy, 2006

Detection Date	Location	Species	Detection Type	Comments
29-Jun-95	[redacted]	HAPE/NESH	U	Species uncertain
7-May-96	[redacted]	UNK	V	Two birds observed
21-May-96	[redacted]	NESH	A	Mauka of camp
5-Jun-96	[redacted]	UNK	V	Two birds observed
7-Apr-97	[redacted]	HAPE	A	[redacted]
16-Apr-97	[redacted]	HAPE	A	Detection just after sunset
13-May-97	[redacted]	HAPE	U	
21-Apr-98	[redacted]	HAPE	A	Detection occurred at 7:45 pm
11-Aug-98	[redacted]	UNK	A	Unusual, faint vocalizations; possibly NESH
25-May-99	[redacted]	NESH	A	Reported >1 individual call
1-Jun-99	[redacted]	HAPE/NESH	A	
19-Jun-99	[redacted]	HAPE	A	
26-Jul-99	[redacted]	NESH	A	
19-Apr-00	[redacted]	HAPE	A	One call reported
16-May-00	[redacted]	HAPE	A	One call reported, after 8:00 pm
13-Jun-00	[redacted]	NESH	A	One call reported, ~7:55 pm
13-Jun-00	[redacted]	HAPE	A	One call reported, ~8:45 pm
31-Mar-01	[redacted]	HAPE	A	2-3 calls in Honokawai Valley, 8:05 pm
17-Apr-01	[redacted]	HAPE	A	2 calls reported, 9:20 pm
10-May-01	[redacted]	HAPE	A	One call reported
28-May-03	[redacted]	UNK	O	Strong fish scent reported from uluhe-covered spur near Transect 4
21-Jul-05	[redacted]	HAPE	A, V	[redacted]
Apr-04	[redacted]	HAPE	U	

Detection Codes: A = audio; V = visual; O = olfactory; U = unknown
Species Codes: HAPE = Hawaiian Petrel; NESH = Newell's Shearwater; UNK = Unknown

Summary of Preliminary Field Investigations in West Maui during Fall, 2005

Date	Location	AM/PM	Observers	Results
24-Sep-05	[redacted]	PM	HO	No detections; 1 feral cat observed
28-Sep-05	[redacted]	AM/PM	HO	Overnight; no detections

Date	Location	AM/PM	Observers	Results
12-Oct-05	[redacted]	AM/PM	HO	Overnight; no detections; some nest searching
19-Oct-05	[redacted]	AM/PM	HO	Overnight; no detections; some nest searching

HO = Hank Oppenheimer

Summary of Hawaiian Petrel and Newell's Shearwater Nesting Colony Search Efforts, West Maui, Hawaii
Kaheawa Pastures Wind Energy, 2006

Date	Location	Description	Observations
26-Jun-06	[redacted]	[redacted]	PM: One HAPE audio detection near camp at 21:45
27-Jun-06	[redacted]	[redacted]	AM: One seaward visual detection (species UNK) at 04:30
27-Jun-06	[redacted]	[redacted]	PM: No detections, heavy clouds and mist obscure visual obs.
28-Jun-06	[redacted]	[redacted]	AM: No detections, precipitation limiting
18-Jul-06	[redacted]	[redacted]	PM: No detections; sub-optimal observation site
19-Jul-06	[redacted]	[redacted]	AM: One seaward HAPE/NESH target detected visually; flying along northern rim of Honokahau Valley, [redacted]
14-Aug-06	[redacted]	[redacted]	PM: Heavy rain and cloud cover inhibits observations
15-Aug-06	[redacted]	[redacted]	AM: Heavy rain and cloud cover inhibits observations
15-Aug-06	[redacted]	[redacted]	PM: Good observation conditions, no detections
12-Sep-06	[redacted]	[redacted]	PM: Two HAPE targets detected visually, inland; one Hoary Bat
13-Sep-06	[redacted]	[redacted]	AM: No detections
13-Sep-06	[redacted]	[redacted]	PM: No detections
14-Sep-06	[redacted]	[redacted]	AM: No detections

HAPE = Hawaiian Petrel
NESH = Newell's Shearwater
UNK = Unknown (suspected) shearwater/petrel target

APPENDIX 4

UPC KAHEAWA WINDPOWER

BOTANICAL RESOURCES ASSESSMENT

IN THE TURBINE FATALITY SEARCH PLOTS

KAHEAWA, HANA'ULA, WEST MAUI

by

ROBERT W. HOBDY
ENVIRONMENTAL CONSULTANT
Kokomo, Maui
August 2006

Prepared for: Kaheawa Wind Power, LLC

INTRODUCTION

The Kaheawa Windpower Project consists of an array of 20 wind turbines situated on a remote ridge top above the southern tip of West Maui between 1900 feet and 3200 feet elevation. These large turbines came on line in June 2006 and are producing electricity for Maui communities. A condition for the approval of this project that was imposed by the US Fish and Wildlife Service was that UPC Kaheawa Windpower monitor for the incidence of Threatened or Endangered bird and bat mortality from the large turbine blades. Species of concern are the Hawaiian petrel (*Pterodroma sanwichensis*), Newell's shearwater (*Puffinus newelli*), Nēnē (*Branta sanvicensis*) and the Hawaiian hoary bat (*Lasiurus cinereus semotus*). Fatality search plots were established around each turbine measuring 180 m x 200 m (see attached map) and search protocols were developed. One of the concerns voiced by US Fish and Wildlife Service in the conduct of the searches was that no Threatened or Endangered plant species be destroyed in the process of searching for Threatened or Endangered wildlife species. To this end a contract was entered into to accomplish the following:

1. To survey the fatality search plots to determine whether sensitive native botanical elements exist that might be impacted by periodic downed wildlife searches.

2. Where search areas overlap Manawainui and Palalaua Gulches, determine if there would be environmental risks to assessing these areas with regard to Threatened or Endangered species and special intact habitats.

3. Determine the percent molasses grass cover within each of the 20 fatality search plots.

The survey and assessment work was conducted in July, 2006.

SITE DESCRIPTION

The project area lies on a moderately sleeping ridgetop extending from 3,200 feet elevation at the top to 1,900 feet elevation at the bottom. At the top the ridge is about 350 feet wide and vegetated with a low diverse native shrubland composed primarily of ʻōhiʻa (*Metrosideros polymorpha*), ʻaʼaliʻi (*Dodonaea viscosa*) and ʻūlei (*Osteomeles anthyllidifolia*). Below the fourth turbine the ridge broadens out into a wide largely non-native grassy slope with scattered shrubs. Near the bottom the broad ridge becomes drier with hardier grasses, shrubs and small trees.

At the top of the project two deep gulches border the narrow ridge top. On the east is Manawainui Gulch. This gulch has a dense growth of native, mesic forest with several rare plant species. It was set aside as Manawainui Plant Sanctuary over 20 years ago and

is protected by a game-proof fence. On the west side of the ridge is Papalaua Gulch. This gulch is also predominantly native, mesic forest with some rare plant species, but it is not fenced and has suffered more damage from cattle and goats over the years.

Rainfall at the top of the project averages about 60 inches per year but decreases rapidly downslope where it averages only about 20 inches per year at the bottom (Armstrong, 1983). Soils vary from Olelo silty clay at the top of the project to Naiwa silty clay loam in the center area to Oli silt loam at the bottom. These are all deep, dark-red soils developed from volcanic ash overlaying basic igneous rock (Foote et al, 1972).

BIOLOGICAL HISTORY

In pre-contact times this mountain slope was entirely covered with native vegetation of low stature with dry grass and shrublands below and mesic to wet, windblown forests above. The Hawaiians made some uses of forest resources here and had a cross-island trail cresting the ridge at 1600 ft. elevation. This trail was upgraded during the mid-1800s and used as a horse trail to Lahaina. It was resurrected to use in recent years and is the present Lahaina Pali Trail.

Cattle ranching began in the late 1800s and continued for over 100 years. During this time the grazing animals consumed most of the native vegetation which was gradually replaced by hardy weed species.

During the 1950s Maui Electric Co. installed high voltage power lines along with access roads through this area. Increased traffic brought more disturbances and weeds. Fires became more frequent, further eliminating remnant native vegetation.

With the cessation of cattle grazing a number of grass and weed species have proliferated, creating a heightened fire hazard. A large fire swept across the mountain in 1999 consuming more than 2500 acres, further depleting native resources. Today some native forest remnants persist in steep gulches or on barren ridge tops, and above the forest fence.

SURVEY METHODS

The Threatened and Endangered plant species or rare species that are known to inhabit the area within a mile distance from the wind turbine array include the following species: (*Remya mauiensis*) no common name, ‘iliahi (*Santalum freycinetianum* var. *lanaiense*), (*Diellia erecta*) no common name, pauoa (*Ctenitis squamigera*), (*Cystopteris douglasii*) no common name, (*Cyanea obtusa*) no common name, ha’iwale (*Cyrtandra oxybapha*), (*Schiedea pubescens*) no common name, ko’oko’olau (*Bidens campylotheca* sbsp. *Pentamera*) and koki’o ‘ula’ula (*Hibiscus kokio*). These species are known from the higher elevations relative to the

wind turbine array and all of them occur in deep gulch bottoms where native vegetation remains in the best condition. The closest representatives are in the bottoms of Papalaua and Manawainui Gulches adjacent to turbine 1-4. While these species were specifically targeted, the searches looked at all native species to ascertain if there were other Threatened and Endangered species present. Many other native species occur in these two gulches and some extend to the ridge top around turbines 1 and 2, but none of these species are rare enough to warrant Federal protection at this time. A number of common dryland native plants are scattered within the non-native grasslands around the lower turbines.

UPC Kaheawa Windpower employees marked the corners of the 180 m x 200 m fatality search plots to insure that the limits of the plots could be accurately located during the survey. These well demarcated search plots were then surveyed using a systematic walk-through method to ascertain that all portions were seen and assessed. Where the search plots overlapped into the steep sided Papalaua and Manawainui gulches (turbines 1-4) a different search protocol was used. First the gulches were carefully glassed with binoculars from the upper rims to look for and identify native species clinging to the steep slopes. Then the gulches were entered along small side ridges where the accessible lower slopes and gulch bottoms within the plots were searched. It is noted here that significant portions of these gulches were too steep to traverse without ropes and climbing gear.

The search plots were also assessed for molasses grass cover. This was done visually by estimating the per cent molasses grass cover in each of four quadrants around each turbine, then averaging these four values to come up with an overall total for each search plot.

RESULTS

Ridgetop fatality search plots – No Threatened or Endangered plant species were found on the ridgetop portions of the search plots. There were a nice variety of common native species scattered throughout the project area but none were protected species. The best diverse native habitat exists at the top of the project area around turbines 1 and 2. Furthermore, the ridge top habitat within the Manawainui Plant Sanctuary fence is in excellent condition. This area has been protected from cattle and other browsing ungulates for over 20 years and the vegetation is very dense and nearly 100% native.

Manawainui and Papalaua Gulch overlap areas – One group of three Endangered ‘iliahi (*Santalum freycinetianum var. lanaiense*) was found in search plot #1 in Papalaua Gulch. This group of ‘iliahi is on the west side of Papalaua stream course in the extreme west corner of the plot. No other Threatened or Endangered species were found within these special search areas.

Two he'au (*Exocarpos gaudichaudii*), which is a Species of Concern, were found in Manawainui Gulch within search plot #2, and another Endangered 'iliahi was found nearby but outside the search area.

These rare elements have been mapped and are being shown to the UPC Kaheawa Windpower biologist.

The portions of Manawainui Gulch that lie within search plots 1-4 are nearly 100% native, densely vegetated and are very steep. They comprise a very intact ecosystem that would be very difficult to survey for downed birds and bats, and that would be greatly fragmented and damaged in the process. Papalaua Gulch is only slightly less steep than Manawainui Gulch and is more fragmented with plenty of molasses grass mixed in with the native trees and shrubs. The gulch bottom also has dense stands of the aggressive weed daisy fleabane (*Erigeron karvinskianus*). This gulch would also be very difficult to survey and any dead birds or bats would be almost impossible to find.

Molasses grass assessment – Molasses grass amounts varied considerably from one plot to the next, and in fact varied considerably in different quadrants within each plot. Where molasses grass gets a foothold it tends to proliferate and smother the low growing native species it is near. The figures calculated here may even be slightly conservative as many small young plants were noticed among larger neighboring plants. These will grow substantially over the next couple years, driving up the percentages of future surveys of this kind. Furthermore, if this area burns again in the coming years, the process will be even further accelerated. Here are the current estimates of molasses grass cover by plot.

Plot 1 = 25%
Plot 2 = 35%
Plot 3 = 40%
Plot 4 = 50%
Plot 5 = 35%
Plot 6 = 30%
Plot 7 = 50%
Plot 8 = 40%
Plot 9 = 35%
Plot 10 = 30%
Plot 11 = 25%
Plot 12 = 60%
Plot 13 = 60%
Plot 14 = 45%
Plot 15 = 25%
Plot 16 = 30%
Plot 17 = 30%
Plot 18 = 30%
Plot 19 = 20%
Plot 20 = 05%

Plots 5 through 15 had significant areas with nearly solid molasses grass cover on smooth terrain that might lend themselves to a mowing scheme. Plots 1 through 4 may have too many native plants for this to work, and plots 16 through 20 appear to be too uneven and rocky as well as having many scattered dryland native plants.

DISCUSSION AND RECOMMENDATIONS

The main goal driving this botanical resource assessment was to evaluate whether significant botanical resources will be compromised or destroyed in the proposed periodic searches for injured or dead Endangered birds and bats within the delineated fatality search plots. The main focus was on Federally listed Threatened or Endangered plant species that cannot be further compromised by conscious management actions. A secondary concern was whether the proposed searches would fragment or destroy healthy and intact ecosystems. A third question was whether effective or safe searches could even be conducted on some of the steep terrain where the fatality search plots overlap Manawainui and Papalaua Gulches.

The search for Threatened or Endangered species turned up just one grouping of three Endangered ʻiliahi in the westernmost corner of plot #1 in the bottom of Papalaua Gulch. This population will be easy to identify and avoid as it is across the stream channel from the main plot. It will be clearly mapped, marked on the ground and included in any search protocols.

The second concern regarding good, intact habitat refers only to the gulch sections of plots 1 through 4 and the ridge top areas of plots 1 and 2. The ridge top portions of the plots 1 and 2 outside of the Manawainui Plant Sanctuary fence already have a lot of small cattle trails through them from former grazing activities.. These areas can be surveyed fairly effectively without incurring significant increased damage. The ridge top portions within Manawainui Plant Sanctuary as well as its steep gulch portions are a different matter. The ridge top portion has been cattle-free for over 20 years and is in excellent shape with no trails. The steep gulch sides are also in excellent shape. Both of these areas would incur significant environmental damage if surveyed periodically, counter to the intent for which the Sanctuary was set aside and is presently being managed. It is recommended the Manawainui Plant Sanctuary be excluded from the fatality search plot monitoring plan.

The Papalaua Gulch portions of plots 1 through 3 are not as pristine as the Manawainui Gulch portions. Significant weediness in the form of molasses grass and daisy fleabane exists. The slopes are steep and the vegetation is deep and thick. While surveying is possible here, it would be physically difficult and the chances of finding any downed birds or bats is slim at best. Here again the benefits of conducting a survey on these slopes would not justify the environmental damage that would be sustained. It is also recommended that fatality searches not be conducted on the steep slopes of Papalaua Gulch.

The third concern regarding the steepness of gulch terrain and the safety of those engaged to survey these areas is a major concern. I do not feel that the use of ropes and climbing equipment justifies the benefits to be derived from such activity here. This further supports the above recommendations not to conduct fatality searches on the steep slopes of Manawainui and Papalaua Gulches.

LITERATURE CITED

Armstrong, R. W. (ed.) 1983. Atlas of Hawaii. (2nd. ed.) University of Hawaii Press.

Foote, D.E. , E.L. Hill, S. Nakamura, and F. Stephens. 1972. Soil survey of the islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii. U.S. Dept. of Agriculture, Soil Conservation Service. Washington, D.C.

APPENDIX 5a. Example of WEOP Wildlife Update

WILDLIFE UPDATE

Kaheawa Pastures Wind Energy

*****Please Read Carefully*****
October 18, 2006

Recent observations by Wildlife personnel at the Kaheawa Pastures Wind Energy facility have indicated a new change in Nene activity on site. At present we are entering into the breeding season for the Nene (Hawaiian Goose). We appreciate all the reports we are receiving from workers on site regarding when and where Nene have been observed. However, with the advent of the breeding season their behavior has changed and the birds will be more likely to be seen on the ground as opposed to just overflying the site. Please continue to help us in our endangered species protection efforts by proceeding in the following manner:

VEHICLE TRAVEL AT ALL TIMES SHOULD REMAIN WITHIN THE INDICATED SPEED LIMITS AS POSTED (15 MPH)

DRIVERS SHOULD REMAIN AWARE THAT NENE ARE MOVING ON FOOT WITHIN ALL PORTIONS OF THE SITE AND MAY CROSS THE ROAD AT ANY TIME, REGARDLESS OF THE TYPE OF VEHICLE APPROACHING

NENE OFTEN FLY OVER AND WITHIN THE SITE AND MAY LAND ON OR CLOSE TO ROADS OR WORK AREAS, ALWAYS CHECK YOUR SURROUNDINGS BEFORE BACKING UP OR PULLING OFF TO THE ROADSIDE

PLEASE REMEMBER TO PICK UP ANY FOOD SCRAPS OR RUBBISH THAT MAY HAVE INADVERTANLY BEEN DROPPED ON THE GROUND

PROMPTLY REPORT ALL NENE SIGHTINGS, INCLUDING TIME, LOCATION, NUMBER OF BIRDS, AND IF SMALL BIRDS (GOSLINGS OR JUVENILES) ARE PRESENT. **VERY IMPORTANT!**

<u>REPORTS SHOULD BE DIRECTED TO</u>:

GREG SPENCER (SENIOR WILDLIFE BIOLOGIST)
298-5097

IAN BORDENAVE (WILDLIFE BIOLOGIST)
343-1680

Thank-you for being mindful and for your cooperation. Have a safe and tropical day!

APPENDIX 5b. WEOP Observation Form contained in WEOP Logbook

Wildlife Education and Observation Program
Kaheawa Pastures Wind Energy Facility

Observation Form

Observer Name: **Date:** **Time:**

Temperature: **Wind Direction:** **Wind Speed:** **Precipitation:** **Cloud Cover:**

Species Observed

Location

Proximity to Turbine
(In Meters)

Approximate Altitude
(In Meters)

Direction Traveling

Other Species in Area

Comments