Draft Habitat Conservation Plan for Pakini Nui Wind Farm

Prepared for

Tawhiri Power LLC

Prepared by

SWCA Environmental Consultants

May 2016

DRAFT HABITAT CONSERVATION PLAN FOR PAKINI NUI WIND FARM

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EXECUTIVE SUMMARY

Pakini Nui Wind Farm, located near South Point on the Island of Hawaiʻi, is a 21-megawatt (MW) operating wind energy facility (hereafter referred to as the Project). Construction of the Project began in August 2006 and was completed in April 2007. The Project, consisting of 14 General Electric (GE) 1.5-MW SE turbines, began operations on April 3, 2007. Tawhiri Power LLC (Tawhiri) owns and operates the Project.

As of March 18, 2016, two Hawaiian hoary bat (*Lasiurus cinereus semotus*) fatalities have been observed at the Project Area. This species is listed as endangered under the Endangered Species Act of 1973, 16 United States Code 1531-1544 (ESA). The first observation (August 31, 2013) marked the first site-specific data available to Tawhiri, indicating that there was the potential for an incidental take of an ESA-listed species at the Project. This Hawaiian hoary bat fatality was found at the start of the intensive, weekly monitoring effort, during a scheduled search. The second Hawaiian hoary bat was found on March 1st, 2016, after approximately 2 ½ years of intensive searching. Prior to the weekly searches, Tawhiri performed less intensive, monthly searches of all turbines since Commercial Operation Date (COD), during which no fatalities were found.

Further, based on initial desktop-based risk assessments and avian field surveys (SWCA 2015a, 2015b, 2015c), Tawhiri has determined that the incidental take of four species could occur from the continued operation of the Project. Of the following four species, three are state listed and ESA federally listed, and one is state listed only. These four species, which make up the Covered Species discussed in this HCP (see section 3), are listed below:

- Hawaiian hoary bat (federally and state endangered)
- Hawaiian petrel (*Pterodroma sandwichensis*; federally and state endangered)
- Band-rumped storm petrel (*Oceanodroma castro;* species proposed for federal listing and state endangered)
- Hawaiian goose (Nēnē; *Branta sandvicensis*; federally and state endangered)

No other listed, proposed, or candidate species have been found or are known or expected to be present in the Project area.

ESA Section 9 prohibits take, unless authorized as incidental take under Section 10. Incidental take as a result of collision with operational turbines may occur as a result of the Project. Therefore, to comply with the ESA and Hawaiʻi Revised Statutes (HRS), and to avoid future potential violations of ESA Section 9 and HRS 195D take prohibition, Tawhiri is voluntarily preparing this HCP and applying to the U.S. Fish and Wildlife Service for an Incidental Take Permit (ITP) in accordance with Sections 10(a)(1)(B) and 10(a)(2) of the ESA, and to the Hawaiʻi Division of Forestry and Wildlife for an Incidental Take License (ITL), pursuant to Hawaiʻi Revised Statutes Chapter 195-D. This HCP has been prepared to fulfill regulatory requirements of both the ITP and ITL applications.

This HCP contains operational minimization measures, most notably low wind speed curtailment, and mitigation measures to offset the impacts of potential incidental take. Mitigation for the Hawaiian hoary bat consists of habitat improvement at the Kahuku Unit of Hawaiʻi Volcanoes National Park. Habitat improvement includes removal of invasive plant species and planting of desired native species. Mitigation for the Hawaiian hoary bat also includes a research project to determine the effect of habitat restoration actions on Hawaiian hoary bat activity levels and food resources. Mitigation for Hawaiian petrels and band-rumped storm petrels consists of a monetary contribution toward the construction of a cat-proof fence around a Hawaiian petrel nesting colony at Hawaiʻi Volcanoes National Park, along with predator control and fence maintenance. Mitigation for nēnē is to provide funding to the Hawaiʻi Department of Land and Natural Resources or other assigned agency or fiduciary upon issuance of the ITP/ITL for predator control and nest protection. All mitigation measures were developed with the intention of providing a net ecological benefit to the species in alignment with state and federal recovery goals.

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ABBREVIATIONS

BLNR	Board of Land and Natural Resources
CARE	carcass retention
CP	carcass persistence
CFR	Code of Federal Regulation
cm	centimeter
COD	Commercial Operation Date
DLNR	Department of Land and Natural Resources
DOFAW	Division of Forestry and Wildlife
EA	environmental assessment
EIS	environmental impact statement
ESRC	Endangered Species Recovery Committee
ESA	Endangered Species Act
FONSI	finding of no significant impact
GE	General Electric
ha	hectare
HAVO	Hawai‘i Volcanoes National Park
HCP	Habitat Conservation Plan
HRS	Hawai‘i Revised Statute
ITL	Incidental Take License
ITP	Incidental Take Permit
km	kilometer
m	meter
MBTA	Migratory Bird Treaty Act
met	meteorological
mm	millimeter
MW	megawatt
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPS	National Park Service
O&M	Operations and Maintenance
SE	
SEEF	searcher efficiency
SWCA	SWCA Environmental Consultants
U.S.	United States
USFWS	U.S. Fish and Wildlife Service

1. INTRODUCTION AND PROJECT OVERVIEW

Pakini Nui Wind Farm is a 21-megawatt (MW) operational wind energy facility (the Project; Figure 1.1) near South Point on the Island of Hawaiʻi. Construction of the Project began in August 2006 and was completed in April 2007. The Project, consisting of 14 General Electric (GE) 1.5-MW SE turbines, began operations on April 3, 2007. Tawhiri Power LLC (Tawhiri) owns and operates the Project.

Tawhiri has completed a number of wildlife studies at the Project. These efforts include the following:

- Avian report (Day 2005)
- Fatality monitoring reports (Tawhiri Power 2007–2013)
- Avian field survey and survey report (SWCA 2015a)
- Acoustic bat activity monitoring (SWCA 2015b)
- Fatality monitoring (SWCA 2015c)

As of March 18, 2016, two Hawaiian hoary bat (*Lasiurus cinereus semotus*) fatalities have been observed at the Project Area. This species is listed as endangered under the Endangered Species Act of 1973, 16 United States Code 1531-1544 (ESA). The first observation (August 31, 2013) marked the first site-specific data available to Tawhiri, indicating that there was the potential for an incidental take of an ESA-listed species at the Project. This Hawaiian hoary bat fatality was found at the start of the intensive, weekly monitoring effort, during a scheduled search. Prior to the weekly searches, Tawhiri performed less intensive, monthly searches of all turbines since COD, during which no fatalities were found. The second Hawaiian hoary bat fatality was found during routine weekly searches on March 1st, 2016.

Further, based on initial desktop-based risk assessments and avian field surveys (SWCA 2015a, 2015b, 2015c), Tawhiri has determined that the incidental take of 4 species could occur from the continued operation of the Project. Of the following four species, three are both state listed and ESA federally listed, and one is state listed only. These four species, which make up the Covered Species discussed in this HCP (see section 3), are listed below:

- Hawaiian hoary bat (federally and state endangered)
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- Hawaiian goose (Nēnē; *Branta sandvicensis*; federally and state endangered)

To comply with the ESA and to avoid future potential violations of ESA Section 9 take prohibition, Tawhiri is voluntarily preparing this HCP, and is applying to the U.S. Fish and Wildlife Service (USFWS) for an Incidental Take Permit (ITP), in accordance with Sections 10(a)(1)(B) and 10(a)(2) of the ESA, and to the Department of Land and Natural Resources (DLNR) for an Incidental Take License (ITL), pursuant to Hawaiʻi Revised Statutes (HRS) Chapter 195-D. This HCP has been prepared to fulfill regulatory requirements of both the ITP and ITL applications.

1.1. Applicant

The applicant for incidental take authorization related to the Project is Tawhiri. Tawhiri is a partnership made up of wholly owned subsidiaries of Apollo Energy Corporation and GE Capital Corporation.

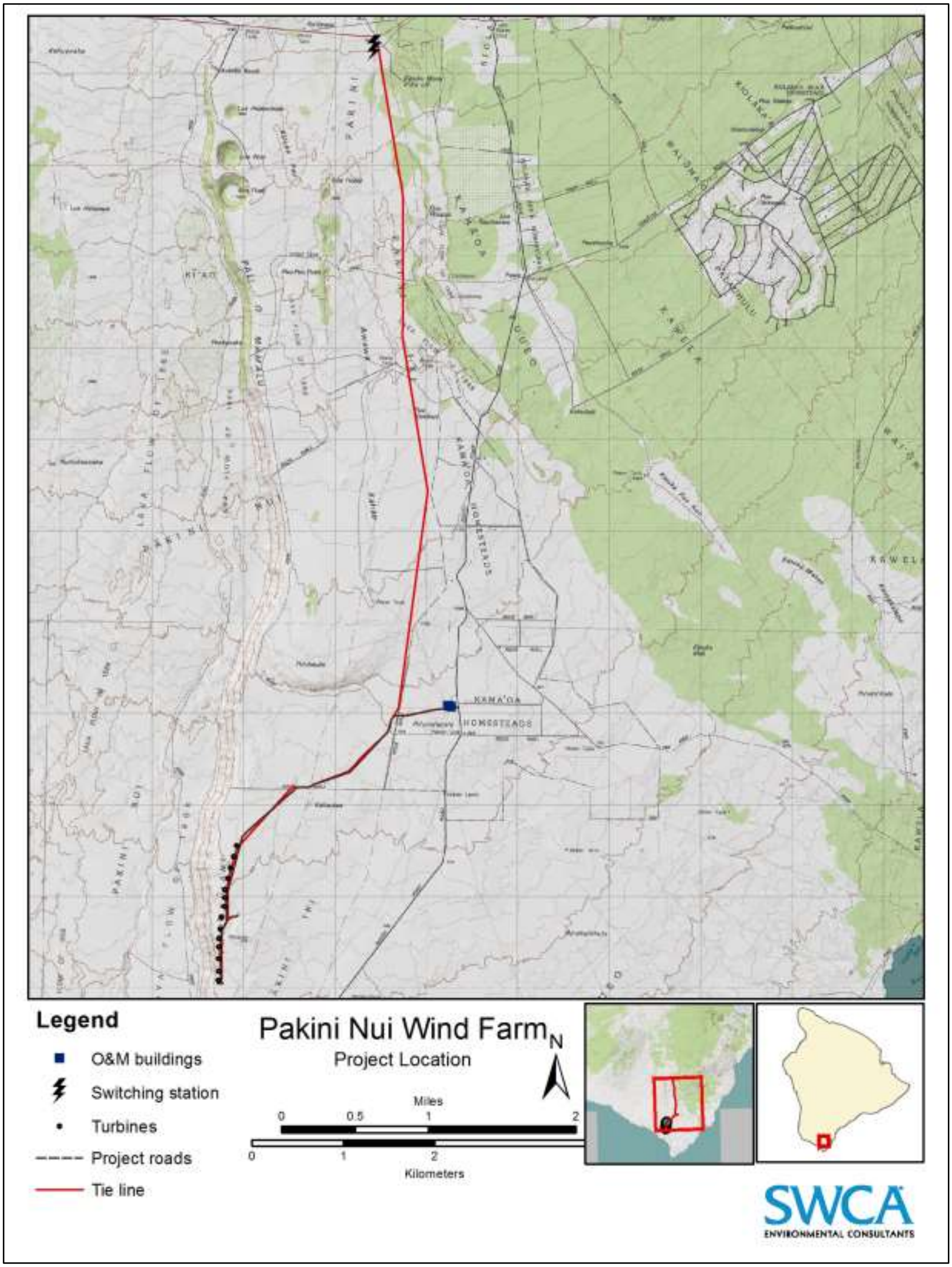

Figure 1.1. Pakini Nui Wind Farm project location (O&M = operations and maintenance).

1.2. Project Description

The Project, located near South Point on the Island of Hawaiʻi, is a 21-MW operating wind energy facility (see Figure 1.1). Construction of the Project began in August 2006 and was completed in April 2007. The Project, consisting of 14 GE 1.5-MW SE turbines, began operations on April 3, 2007. Tawhiri owns and operates the Project.

A number of project components are on leased lands (Figure 1.3). The Project wind turbine easement is 9.8 ha (24.3 acres), the tie-line easement is 22.2 ha (54.9 acres), and the met tower easement is 0.09 ha (0.22 acre). Together these lands comprise the Project Area, which totals 32.09 ha (79.42 acre).

Turbines are constructed of tubular towers with a hub height of approximately 65 meters (m) (213 feet); the rotor blades are approximately 70 m (230 feet) in diameter and reach a maximum height of 100 m (328 feet). Project turbines can be programmed to begin spinning at specific wind speeds and to stop spinning (shut down) at specific wind speeds. The turbines are operated independently, based on individual turbine anemometry. One lattice structure meteorological (met) tower 62 m (205 feet) high is approximately 183 m (600 feet) east of the middle of the turbine string.

The Project uses a 9.6-kilometer (km)-long (6-mile-long) aboveground transmission line to deliver power generated at the wind farm to the local power grid. This line is a single-conductor three-circuit line operating at 69 kilovolts (grid voltage). There are 82 poles in total: 53 are 17.3 m (57 feet) tall, 21 are 18.5 m (61 feet) tall, two are 15.8 m (52 feet) tall, two are 21.3 m (70 feet) tall, two are 22.9 (75 feet) tall, one is 20 m (66 feet) tall, and one is 24.0 m (79 feet) tall. Spacing between poles is approximately 122 m (400 feet), with three poles having two guy wires, six poles having four guy wires, one pole having six guy wires, and three poles having eight guy wires. The remaining posts are free standing. Most of the guyed poles (eight) occur along the lower 2.4 km (1.5 miles) of the transmission line. A static line runs along the top of the poles and a fiber optic communications line is located approximately 20 feet from the ground.

The Project also comprises approximately 3.2 km (2 miles) of roads, 1.6 km (1 mile) of underground connector lines, a 0.6-hectare (ha) (1.5-acre) operations and maintenance (O&M) building area, and a 0.48-ha (1.2-acre) substation (see Figure 1.1). Monthly on-site equipment checks using both 2-wheel- and 4-wheel-drive vehicles are conducted.

Minimization measures implemented at the Project Area and intended to decrease the risk of take to Covered Species are as follows (also described in section 6.1):

- Minimize nighttime activities to avoid the use of lighting that could attract Hawaiian petrels, band-rumped storm petrels, and possibly Hawaiian hoary bats.
- Minimize use of on-site lighting at buildings. Use shielded fixtures only on infrequent occasions when workers are at the Project at night. Outdoor lighting will be fully shielded. Outdoor lights will be restricted to what are needed for safety reasons, and will only be used in emergency situations, which typically occur twice per year. Otherwise, no nighttime activities will occur on-site.
- Observe a speed limit of 40 km (25 miles) per hour while driving at the Project Area. This will help minimize collision with Covered Species, in the event they are using habitat on-site or are injured. If nēnē are observed at or near the site, a speed limit of 15 mph will be observed.
- Do not use barbed wire on perimeter fencing within the leased area because it poses an entangling risk to Hawaiian hoary bats.

- If gaps in grazing activity occur, maintain vegetation height within the leased area so as not to attract nēnē breeding behavior.
- Refrain from purposely approaching and maintain a distance (by foot or vehicle) of 30 m (100 feet) from nēnē when present on-site in order to avoid erratic flight behavior that may increase strike risk.
- Low wind speed curtailment, as described in section 6.2, below.

1.3. Purpose and Need

Tawhiri and its managing member, Apollo Energy Corporation, have been providing clean, renewable energy from wind facilities located near South Point on the Island of Hawai‘i since the mid-1980s. The current Project was installed in 2007 to replace the old Kamao‘a wind farm, an obsolete and decommissioned farm located several miles northwest of the Project area (where the current O&M building is located). The new wind farm uses turbines with greater efficiency, greater power performance and output, and significantly reduced hub rotational speeds. Fourteen turbines are able to triple the generation that 37 smaller turbines had provided. These new turbines are also able to “ride through” all but the most significant grid events, staying online and providing critical power to rate payers when other conventional fossil-fueled generators have tripped offline. Finally, the Project is able to provide up to 20% of Hawai‘i’s total electrical generation needs, providing significant contribution to the county and state renewable portfolio, while providing cost-effective, clean, renewable energy for nearly 18,000 homes annually.

1.4. Covered Activities

Covered Activities discussed in this HCP are those activities that could result in an incidental take of 1 or more Covered Species and for which Tawhiri seeks incidental take authorization (See section 1.2 above). Of the Project components and activities described in section 1.2, only the ongoing existence of the met tower and operation of turbines present a likelihood for an incidental take of a Covered Species. Approximately 9.6 km (6 miles) of aboveground tie-lines connect the Project to the island’s power grid, and although the risk of collision between a Covered Species and a portion of the Project tie-line is discountable (see sections 3.1.2, 3.2.2, 3.3.2, and 3.4.2), it is also included as a covered activity. Therefore, these are the only Project components and activities for which Tawhiri seeks incidental take authorization. Presence and use of the O&M building and substation do not present potential effects to Covered Species.

1.5. Permit Area and Plan Area

The *Permit Area* for this HCP is the geographical area within which incidental take resulting from covered activities is expected to occur. The Permit Area is shown in Figure 1.2 and is approximately 45 ha (111.2 acres).

Cattle and feral goats routinely graze the areas below and surrounding the turbines. Vegetation in these areas consists mostly of buffelgrass (*Cenchrus ciliaris*), which is grazed to stubble and interspersed with occasional lantana bush (*Lantana camara*) and kiawe tree (*Prosopis pallida*). The cliff west of the turbine string has similar vegetation, but offers shelter from both wind and ungulates; therefore, this area hosts more and larger kiawe trees. The areas south and east of the wind farm consist mostly of grazed buffelgrass grasslands interspersed with non-native trees, such as kiawe tree. North of the Project, the vegetation becomes gradually more shrubby and woody, with mostly non-native tree and shrub species.

At the northernmost portion of the tie-line, the vegetation consists of mostly native forest, with ʻōhiʻa (*Metrosideros polymorpha*) and pūkiawe *(Leptecophylla tameiameiae*) as dominant species.

The Permit Area experiences relatively high average wind speeds. Wind direction is predominantly between 70˚ north and 90˚ north.

Additional lands addressed in the HCP are those that will be used for mitigation. Those areas are addressed in section 8.

Together, the Permit Area and mitigation lands define the *Plan Area*.

A number of project components are on leased lands (Figure 1.3). The Project wind turbine easement is 9.8 ha (24.3 acres), the tie-line easement is 22.2 ha (54.9 acres), and the met tower easement is 0.09 ha (0.22 acre).

1.6. ITP/ITL Duration

Tawhiri seeks incidental take authorization for a period of 20 years from the date of USFWS and DLNR authorization. This covers the anticipated remaining operating life of the Project and the decommissioning/deconstructing stage, or the time to request renewal or amendment for an extension to the ITP/ITL term.

Figure 1.2. Pakini Nui Wind Farm Permit Area.

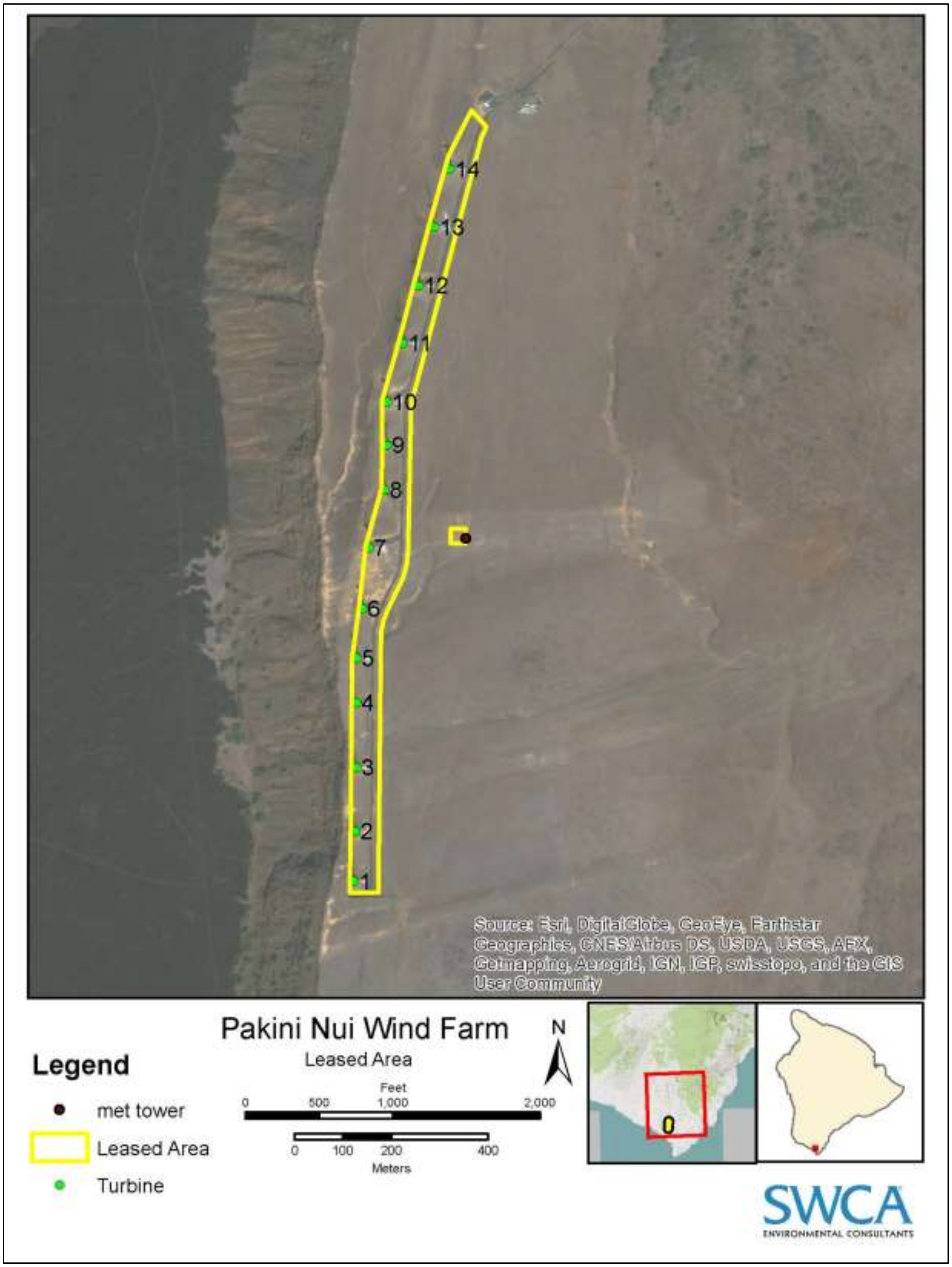

Figure 1.3. Close- up of total Pakini Nui Wind Farm leased area.

2. REGULATORY FRAMEWORK

This HCP has been prepared to fulfill regulatory requirements of both the ITP and ITL applications, as described below. Tawhiri is responsible for complying with all federal, state, and local laws, including, without limitation, the Migratory Bird Treaty Act (MBTA).

2.1. Endangered Species Act

The ESA protects wildlife and plant species that have been listed as threatened or endangered. It is designed to conserve the ecosystem on which the species depend. Candidate species, which may be listed in the near future, are not afforded protection under the ESA until they are formally listed as endangered or threatened.

Section 9, and rules promulgated under Section 4(d), of the ESA prohibits the unauthorized take of any endangered or threatened species of wildlife listed under the ESA. Under the ESA, the term take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect species listed as endangered or threatened, or to attempt to engage in any such conduct. As defined in regulations, the term harm means an act that actually kills or injures wildlife; it may include significant habitat modification or degradation, which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 Code of Federal Regulations [CFR] 17.3). The rules define harass to mean an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent, as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3).

By issuance of an ITP under Section 10, the USFWS may permit, under certain terms and conditions, any take otherwise prohibited by Section 9, or a rule under Section 4(d), of the ESA, if such take is incidental to the carrying out of an otherwise lawful activity ("incidental take"). To apply for an ITP, an applicant must develop and fund a USFWS-approved HCP to minimize and mitigate the effects of the incidental take. Such take may be permitted, provided the following ITP issuance criteria of ESA Section 10(a)(2)(B), 50 CFR 17.22(b)(2), and 50 CFR 17.32(b)(2) are met:

- The taking will be incidental.
- The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking.
- The applicant will ensure that adequate funding for the HCP and procedures to deal with unforeseen circumstances will be provided.
- The taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.
- Other necessary or appropriate measures required by the Secretary of the Interior, if any, will be met and the secretary has received such other assurances as he may require that the plan will be implemented.

To obtain an ITP, an applicant must prepare a supporting HCP that provides the following information described in ESA Sections 10(a)(2)(A) and (B), 50 CFR 17.22(b)(1), and 50 CFR 17.32(b)(1):

- The impact that will likely result from such taking.
- The measures that the applicant will undertake to monitor, minimize, and mitigate such impacts; the funding that will be available to implement such measures; and the procedures to be used to deal with unforeseen circumstances.

- The alternative actions to such taking considered by the applicant, and the reasons why such alternatives are not proposed to be used.
- Such other measures that the Secretary may require as necessary or appropriate for purposes of the HCP.

The *Habitat Conservation Planning and Incidental Take Permit Processing Handbook*, published by the USFWS and the National Oceanic and Atmospheric Administration National Marine Fisheries Service in November 1996, provides additional policy guidance concerning the preparation and content of HCPs. The USFWS and the National Oceanic and Atmospheric Administration published an addendum to the *HCP Handbook* on June 1, 2000 (*Federal Register* 2000). This addendum, also known as the Five-Point Policy, provides clarifying guidance for 1) applicants applying for an ITP and 2) agencies issuing ITPs under ESA Section 10. The five components addressed in the policy are discussed briefly below:

Biological Goals and Objectives: HCPs must include biological goals (broad guiding principles for the conservation program and the rationale behind the minimization and mitigation strategies) and biological objectives (the measurable targets for achieving the biological goals). These goals and objectives must be based on the best scientific information available, and they are used to guide conservation strategies for species covered by the HCP.

Adaptive Management: The Five-Point Policy encourages the development of adaptive management plans as part of the HCP process under certain circumstances. Adaptive management is an integrated method for addressing biological uncertainty and devising alternative strategies for meeting biological goals and objectives. An adaptive management strategy is essential for HCPs that would otherwise pose a significant risk to the Covered Species due to significant information gaps.

Monitoring: Monitoring is a mandatory element of all HCPs under the Five-Point Policy. For this reason, an HCP must provide for monitoring programs to gauge the effectiveness of the HCP in meeting the biological goals and objectives and to verify that the terms and conditions of the HCP are being properly implemented.

Permit Duration: Regulations provide several factors that are used to determine the duration of an ITP, including the duration of the applicant’s proposed activities and the expected positive and negative effects on Covered Species associated with the proposed duration (50 CFR 17.32 and 222.307). Under the Five-Point Policy, the USFWS also will consider the level of scientific and commercial data underlying the proposed operational program of the HCP, the length of time necessary to implement and achieve the benefits of the program, and the extent to which the program incorporates adaptive management strategies.

Public Participation: Under the Five-Point Policy guidance, the USFWS announced its intent to expand public participation in the HCP process to provide greater opportunity for the public to assess, review, and analyze HCPs and associated documentation (e.g., National Environmental Policy Act [NEPA] review). As part of this effort, the USFWS has expanded the public review process for most HCPs from a 30-day comment period to a 60-day period.

2.2. Hawai‘i Revised Statutes Chapter 195D

The purpose of HRS Chapter 195D is “to insure the continued perpetuation of indigenous aquatic life, wildlife, and land plants, and their habitats for human enjoyment, for scientific purposes, and as members of ecosystems ….” Section 195D-4 states that any endangered or threatened species of fish or wildlife recognized by the ESA shall be so deemed by state statute. Like the ESA, the unauthorized take of such endangered or threatened species is prohibited (HRS 195D-4(e)). Under Section 195D-4(g), the Board of

Land and Natural Resources (BLNR), after consultation with the State's Endangered Species Recovery Committee (ESRC), may issue a temporary ITL to allow a take otherwise prohibited if the take is incidental to the carrying out of an otherwise lawful activity.

To qualify for an ITL, the following must occur (language adapted from HRS 195D-4(g)):

- The applicant minimizes and mitigates the impacts of the incidental take to the maximum extent practicable (i.e., implements an HCP).
- The applicant guarantees that adequate funding for the HCP will be provided.
- The applicant posts a bond; provides an irrevocable letter of credit, insurance, or surety bond; or provides other similar financial tools, including depositing a sum of money in the endangered species trust fund created by HRS 195D-31, or provides other means approved by the BLNR, adequate to ensure monitoring of the species by the state and to ensure that the applicant takes all actions necessary to minimize and mitigate the impacts of the incidental take.
- The plan increases the likelihood that the species will survive and recover.
- The plan takes into consideration the full range of the species on the island so that cumulative impacts associated with the incidental take can be adequately assessed.
- The activity permitted and facilitated by the license to incidentally take a species does not involve the use of submerged lands, mining, or blasting.
- The cumulative impact of the activity, which is permitted and facilitated by the license, provides net environmental benefits.
- The incidental take is not likely to cause the loss of genetic representation of an affected population of any endangered, threatened, proposed, or candidate plant species.

Section 195D-4(i) directs the DLNR to work cooperatively with federal agencies in concurrently processing HCPs, ITLs, and ITPs. Section 195D-21 deals specifically with HCPs, and its provisions are similar to those in federal regulations. According to this section, HCPs submitted in support of an ITL application shall do the following:

- Identify the geographic area encompassed by the HCP; the ecosystems, natural communities, or habitat types within the plan area that are the focus of the plan; and the endangered, threatened, proposed, and candidate species known or reasonably expected to be present in those ecosystems, natural communities, or habitat types in the plan area.
- Describe the activities contemplated to be undertaken in the plan area with sufficient detail to allow the department to evaluate the impact of the activities on the particular ecosystems, natural communities, or habitat types in the plan area that are the focus of the plan.
- Identify the steps that will be taken to minimize and mitigate all negative impacts, including, without limitation, the impact of any authorized incidental take, with consideration of the full range of the species on the island so that cumulative impacts associated with the incidental take can be adequately assessed; and the funding that will be available to implement those steps.
- Identify those measures or actions to be undertaken to protect, maintain, restore, or enhance the ecosystems, natural communities, or habitat types in the plan area; a schedule for implementation of the measures or actions; and an adequate funding source to ensure that the actions or measures, including monitoring, are undertaken in accordance with the schedule.

- Be consistent with the goals and objectives of any approved recovery plan for any endangered species or threatened species known or reasonably expected to occur in the ecosystems, natural communities, or habitat types in the plan area.
- Provide reasonable certainty that the ecosystems, natural communities, or habitat types will be maintained in the plan area throughout the life of the plan in sufficient quality, distribution, and extent to support in the plan area those species typically associated with the ecosystems, natural communities, or habitat types, including any endangered, threatened, proposed, and candidate species known or reasonably expected to be present in the ecosystems, natural communities, or habitat types within the plan area.
- Contain objective, measurable goals, the achievement of which will contribute significantly to the protection, maintenance, restoration, or enhancement of the ecosystems, natural communities, or habitat types; time frames within which the goals are to be achieved; provisions for monitoring (such as field sampling techniques), including periodic monitoring by representatives of the department or the ESRC, or both; and provisions for evaluating progress achieving the goals quantitatively and qualitatively.
- Provide for an adaptive management strategy that specifies the actions to be taken periodically if the plan is not achieving its goals.

In addition to the above requirements, all HCPs and their actions authorized under the HCP will be designed to result in an overall net benefit to the threatened and endangered species in Hawaiʻi (HRS 195D-30).

Section 195D-25 provides for the creation of the ESRC, which is composed of biological experts, representatives of relevant federal and state agencies (e.g., USFWS, U.S. Geological Survey, and DLNR), and appropriate governmental and non-governmental members. The ESRC serves as a consultant to the DLNR and BLNR on matters relating to endangered, threatened, proposed, and candidate species. ESRC reviews all applications for HCPs and makes recommendations to the DLNR and BLNR on whether they will be approved, amended, or rejected.

Following preparation of the proposed HCP, it and the application must be made available for public review and comment no fewer than 60 days before approval. If the DLNR approves the HCP, participants in the HCP (e.g., the ITL holder) must submit an annual report to DLNR within 90 days of each fiscal year ending June 30, as further detailed in section 7 below; this report must include a description of activities and accomplishments, analysis of the problems and issues encountered in meeting or failing to meet the objectives set forth in the HCP, areas needing technical advice, status of funding, and plans and management objectives for the next fiscal year (HRS 195D-21).

2.3. National Environmental Policy Act

Issuing an ITP is a federal action subject to compliance with the NEPA. The purpose of NEPA is to promote agency analysis and public disclosure of the environmental issues surrounding a proposed federal action to reach a decision that reflects NEPA’s mandate to strive for harmony between human activity and the natural world. The scope of NEPA goes beyond that of the ESA by considering the impact of a federal action on non-wildlife resources, such as water quality, air quality, and cultural resources. The USFWS will prepare and provide for public review an environmental assessment (EA) that evaluates the potential environmental impacts of issuing an ITP and approving the implementation of this HCP. The purpose of the EA is to determine if ITP issuance and HCP implementation will significantly affect the quality of the human environment. If the USFWS determines that significant impacts are likely to occur, a comprehensive environmental impact statement (EIS) for the proposed action will be prepared and distributed for public review; otherwise, a finding of no significant impact (FONSI) will be issued. The USFWS will not make a decision on ITP issuance until after the NEPA process is complete.

2.4. Migratory Bird Treaty Act

All three bird species addressed in this HCP—Hawaiian petrel, band-rumped storm petrel, and nēnē—are also protected under the MBTA of 1918, as amended (16 USC 703-712). The MBTA prohibits the take of migratory birds. A list of birds protected under MBTA implementing regulations is provided at 50 CFR 10.13. Unless permitted by regulations, under the MBTA "it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product."

The MBTA provides no process for authorizing incidental take of MBTA-protected birds. However, if the HCP is approved and USFWS issues an ITP to the Applicant, the terms and conditions of that ITP will also constitute a Special Purpose Permit under 50 CFR §21.27 for the take of the Hawaiian petrel, band-rumped storm petrel, and nēnē under the MBTA. Therefore, subject to the terms and conditions to be specified in the ITP, if issued, any such take of the three listed bird species also will not be in violation of the MBTA. However, because the MBTA provides for no incidental take authorization, other MBTA-protected birds that are not protected by the ESA and that may be adversely affected by the proposed wind facility will not be covered by any take authorization. If take of any MBTA species occurs, these will be documented and reported in a similar fashion to that applied to any endangered or threatened species wildlife listed under the ESA.

On March 23, 2012, the USFWS released *Land-Based Wind Energy Guidelines* (USFWS 2012a). These voluntary guidelines provide recommended approaches for assessing and avoiding impacts to wildlife and their habitats, including migratory birds, associated with wind energy project development. The guidelines also help ensure compliance with federal laws such as the MBTA. The approach described in this document for the proposed development of this Project is consistent with the intent of the guidelines.

3. ECOLOGY OF THE COVERED SPECIES

3.1. Hawaiian Hoary Bat

3.1.1. Population, Biology, and Distribution

The Hawaiian hoary bat is the only native land mammal present in the Hawaiian archipelago. It is a sub-species of the hoary bat (*Lasiurus cinereus*), which occurs across much of North and South America. Males and females have a wingspan of approximately 0.3 m (1 foot), although females are typically larger and heavier than males, weighing on average 17.9 grams (0.6 ounce). Males average 14.2 grams (0.5 ounce). Both sexes have a coat of brown and gray fur. Individual hairs are tipped or frosted with white (Mitchell et al. 2005; Jacobs 1993).

The Hawaiian hoary bat has been recorded on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i, but little historical population estimates or information exists for this subspecies. Recent population estimates for all islands in the state have ranged from hundreds to a few thousand bats (Menard 2001). The Hawaiian hoary bat is believed to occur primarily from sea level to 2,288 m (7,500 ft.), although they have been observed above 3,963 m (13,000 ft.) (USFWS 2012b). In addition research has shown some degree of altitudinal movement over seasons (Gorresen et al. 2013).

Hawaiian hoary bats roost in native and non-native vegetation from 1 to 9 m (3 to 29 feet) above ground level. They have been observed roosting in ‘ōhi‘a, hala (*Pandanus tectorius*), coconut palms (*Cocos nucifera*), ironwood (*Casuarina equisetifolia*), kukui (*Aleurites moluccana*), kiawe tree, avocado (*Persea americana*), mango (*Mangifera indica*), shower trees (*Cassia javanica*), pūkiawe, and fern clumps; they are also suspected to roost in eucalyptus (*Eucalyptus* spp.) and Sugi pine (*Cryptomeria japonica*) stands. The species has been rarely observed using lava tubes, cracks in rocks, or human-made structures for roosting. While roosting during the day, Hawaiian hoary bats are solitary, although mothers and pups roost together (USFWS 1998; Kawailoa Wind Power 2014). One lychee tree near Hilo has been used as a nursery tree by multiple bats (personal communication, D. Sether, USFWS, September 14, 2015).

A preliminary study (November 2004 to August 2008) of a small sample of Hawaiian hoary bats (n = 28) on the Island of Hawai‘i had a mean, estimated, short-term (3–13 calendar days) core use area of 25.5 ha (63.0 acres) (Bonaccorso et al. 2015). The size of home ranges and core areas varied widely among individuals. Core areas included feeding ranges that were actively defended, especially by males, against conspecifics. Female core ranges overlapped with male ranges. Hawaiian hoary bats typically feed along a line of trees, forest edges, or roads, and a typical feeding range stretches approximately 275 m (902 feet). Hawaiian hoary bats will spend 20–30 minutes hunting in a feeding range before moving on to another (Bonaccorso 2011).

It is suspected that breeding primarily occurs between May and October (Gorresen et al. 2013). Lactating females have been documented from June to September (personal communication, D. Sether, USFWS, September 14, 2015), indicating that this is the period when non-volant young are most likely to be present. Breeding has been documented on the Islands of Hawai‘i and Kaua‘i, as well as a singular observation on O‘ahu (Baldwin 1950; Kepler and Scott 1990; Menard 2001; Kawailoa Power, LLC. 2014). Seasonal changes in the abundance of Hawaiian hoary bats at different elevations indicate that altitudinal movements occur on the Island of Hawai‘i. During the breeding period (May through October), Hawaiian hoary bat occurrences increase in the lowlands and decrease at high elevation habitats. In the winter, bat occurrences increase in high elevation areas (above 1,525 m [5,000 feet]) from January through March (Bonaccorso 2011; Menard 2001; Gorresen et al. 2013).

Hawaiian hoary bats feed on a variety of native and non-native night-flying insects, including moths, beetles, crickets, mosquitoes, and termites (Whitaker and Tomich 1983). They appear to prefer moths ranging from 16 to 20 millimeters (mm) (0.60 to 0.89 inch) in size (Bellwood and Fullard 1984; Fullard 2001). Koa moths (*Scotorythra paludicola*), which are endemic to the Hawaiian Islands and use koa (*Acacia koa*) as a host plant (Haines et al. 2009), are frequently targeted as a food source (personal communication, Gorresen, 2013). Microchiroptera bats locate their prey using echolocation. Typical peak frequency for echolocation hunting behavior occurs at 27.8 kilohertz, whereas social calls are recorded at a peak frequency of 9.6 kilohertz (Bellwood and Fullard 1984). Water courses and edges (e.g., coastlines and forest-pasture boundaries) appear to be important foraging areas (Brooks and Ford 2005; Francl et al. 2004; Grindal et al. 1999; Menzel et al. 2002; Morris 2008). In addition, the Hawaiian hoary bat is attracted to insects that congregate near lights (Bellwood and Fullard 1984; Mitchell et al. 2005; USFWS 1998). They begin foraging either just before or after sunset, depending on the time of year (Mitchell et al. 2005; USFWS 1998; Jacobs 1993).

3.1.2. Threats

Little is known regarding threats to the Hawaiian hoary bat. The presumed decline of the species may be due to the decrease in canopy cover during historic times (Tomich 186; Nowak 1994), in particular the severe deforestation on Oahu in the early nineteenth century (Tomich 1986). The main observed mortality of the Hawaiian hoary bat in the State of Hawaiʻi has been from bats snagging on barbed wire and colliding with wind turbines. The extent of the impact of barbed wire fences is unknown, because most are not checked regularly. The extent of mortality at wind farms is well documented (Table 3.1) because intensive monitoring is carried out to document such fatalities. Other threats may include pesticide use, which in the past has impacted federally listed bat species (Clark et al. 1978), and the introduction of non-native species such as introduced invertebrates, which alter the possible prey composition, and coqui frogs, which have the capacity to attain very high densities (Beard et al. 2009) resulting in reductions of total insect biomass (Bernard 2011).

3.1.3. Known Fatalities at Other Hawaiian Wind Farms

Fatalities of Hawaiian hoary bats have been documented at six operational wind farms in Hawaiʻi, including the Project (see Table 3.1).

Table 3.1. Documented Fatalities of Hawaiian Hoary Bats at Wind Farms in Hawaiʻi

Location	Observed Take*	Calculated Take (80% Dalthorp†)
Auwahi Wind Farm (Maui)	5	17
Kaheawa Wind Farm (Maui)	8	29
Kaheawa II Wind Farm (Maui)	3	19
Kahuku Wind Farm (Oʻahu)	4	14
Kawailoa Wind Farm (Oʻahu)	24	42
Pakini Nui Wind Farm (Hawaiʻi)	2	N/A

* *Sources*: Sempra Energy (2015); Kaheawa Wind Power, LLC (2015a, 2015b); Kahuku Wind Power, LLC (2015); Kawailoa Wind Power, LLC (2015),

† The take estimate is based on the *Evidence of Absence Software* (Dalthorp et al. 2014), existing literature, and site-specific data. It includes the indirect take estimate.

In their North American range, hoary bats are known to be more susceptible to collision with wind turbines than most other bat species (Erickson 2003; Johnson 2005; Johnson et al. 2000). Most mortality has been detected during the fall migration period. Hoary bats in Hawai‘i do not migrate in the traditional sense; although, as indicated, some seasonal altitudinal movements occur.

Baerwald et al. (2009) conducted a study during the peak period of migration (August 1–September 7, 2007) for hoary (*Lasiurus cinereus*) and silver-haired bats (*Lasionycteris noctivagans*) at a wind energy installation in southwestern Alberta, Canada, where the dominant fatalities were from the two bat species. Three treatment groups were tested (control turbines, treatment turbines with increased cut-in speed, and experimental idling turbines with the blades manipulated to be motionless during low wind speeds), combining the two experimental treatment results and comparing them to control turbines, Baerwald et al. (2009) concludes that the experimental turbines had lower fatality rates for each species (Arnett et al. 2013).

Cryan et al. (2014) analyzed wind turbine activities at a facility in northwestern Indiana using thermal video-surveillance cameras, supplemented with near-infrared video, acoustic detectors, and radar. Key findings were that wind speed and blade rotation speed influence the way that bats approached turbines. Bats approached turbines less frequently when their blades were spinning fast, and the prevalence of leeward approaches to the nacelle increased with wind speed at turbines with slow-moving or stationary blades (Cryan et al. 2014).

Studies from 10 different operational mitigation wind farms in North America found reductions in fatality rates by altering turbine operations. Most studies found at least a 50% reduction in bat fatalities when turbine cut-in speed was increased by 1.5 m (5 feet) per second above the manufacturer’s cut-in speed. Similar reductions in bat fatality were reported by one study that implemented a raised cut-in speed given temperatures were above 9.5 degrees Celsius. One study demonstrated equally beneficial reductions with a low-speed idling approach, whereas another discovered that feathering turbine blades (pitched 90 degrees and parallel to the wind) at or below the manufacturer’s cut-in speed resulted in up to 72% fewer bats killed when turbines produced no electricity into the power grid (Arnett et al. 2013).

3.1.4. Known Occurrences in the South Point Area

Hawaiian hoary bats appear to be widespread on the Island of Hawai‘i (Jacobs 1994). According to Day (2005), Hawaiian hoary bats have been recorded at South Point. Bats also have been detected in the southern portion of the Kahuku section of Hawai‘i Volcanoes National Park, and are widespread and present year-round (Fraser and HaySmith 2009). The Kahuku section is across the road from the transmission line of the project, and approximately 12.5 km (7.8 miles) from the turbine string.

Bats have been documented in forests as well as pastureland, and may use less-forested areas during the non-breeding season (Gorresen et al. 2013). Gorresen et al. (2013) found that contrary to expectations, bat occupancy was not greater at less-windy sites. Hawaiian hoary bats were as likely to occur at windy sites as at low-wind sites, although the authors did not directly correlate activity levels and wind speeds. Based on these findings, bats are expected to occur at the Project Area, although the sites included in Gorresen’s (2013) study had average wind speeds that were lower than those recorded at the Project Area. The presence of Hawaiian hoary bats at the Project Area was confirmed when a Hawaiian hoary bat carcass was found below turbine 12 on August 31, 2013.

Bat detectors have been in place at the Project Area since December 2013, with one detector placed at the met tower, one near the cliff face downwind of turbine 1, one downwind of turbine 14, and one approximately 1 km (0.6 mile) north of the turbine string (off-site) (SWCA 2015b). The combined average bat activity for all on- and off-site detectors at the Project was 1.87 passes/detector/night. On-site bat activity was 0.36 passes/detector/night. The data show that bats were present throughout all months of the year. Using data from all detectors, the months of June through September were found to be significantly higher ($X^2 = 13.81$, $df = 6$, $P = 0.0318$; SWCA 2015b) in bat activity, whereas October through May were lower activity months. For all detectors, bat activity occurred throughout all hours during which they were recording (6:00 p.m. to 6:00 a.m.). One detector that was placed in the lee of a cliff running north to south along the western boundary of the Project Area recorded a significantly higher ($X2 = 15.36$, $df = 5$, $P < 0.0001$; SWCA 2015b) bat activity rate than all other detectors during both the high and low seasons, but bat activity was not found to be significantly different among the other detectors. It appears that bat activity may show a strong decrease away from the cliff, but there are currently insufficient data to statistically test this hypothesis.

3.2. Hawaiian Petrel

3.2.1. Population, Biology, and Distribution

The Hawaiian petrel was once abundant on all main Hawaiian Islands except Niʻihau (Mitchell et al. 2005). The population was most recently estimated to consist of approximately 20,000 individuals, with 4,000–5,000 breeding pairs (Spear et al. 1995). The once-significant breeding populations of Hawaiian petrels on the Island of Hawaiʻi were reduced to very small numbers by the end of the twentieth century (Banko 1980; Conant 1980; Richardson and Woodside 1954). Today, there are an estimated 100 to 200 breeding pairs on the Island of Hawaiʻi (Pyle and Pyle 2009). Hawaiian petrels continue to breed in high-elevation colonies on Maui, Hawaiʻi, Kauaʻi, and Lānaʻi (Richardson and Woodside 1954; Simons and Hodges 1998; Telfer et al. 1987). Radar studies conducted in 2002 also suggest that breeding may occur on Molokaʻi (Day and Cooper 2002). It is believed that breeding no longer occurs on Oʻahu (Harrison 1990). The largest known breeding colony is at Haleakalā National Park on Maui, where as many as 1,000 pairs have been thought to nest annually (Mitchell et al. 2005). Hawaiʻi Volcanoes National Park currently encompasses the largest active Hawaiian petrel colony on the Island of Hawaiʻi. An accurate population estimate for Hawaiʻi Island is lacking; however, a rudimentary estimate suggests approximately 2,000 individuals (Cooper and Day 2004).

Hawaiian petrels subsist primarily on squid, fish, and crustaceans caught near the sea surface. Foraging may take place thousands of kilometers from their nesting sites during both breeding and non-breeding seasons (Spear et al. 1995). In fact, recent studies using satellites and transmitters attached to Hawaiian petrels show that they can range across more than 10,000 km (6,200 miles) during 2-week foraging expeditions (Adams 2008).

Hawaiian petrels are active in their nesting colonies for approximately 8 months each year. The birds are long-lived (approximately 30 years) and return to the same nesting burrows each year between March and April. The nesting season occurs between late February and November, with Hawaiian petrels accessing their underground burrows nocturnally (Simons 1985). Breeding and prospecting birds fly to the nesting site in the evening and leave for foraging trips before dawn. Mean altitude during transitory inland flight is approximately 190 m (623 feet) aboveground for Maui birds (Day et al. 2003). Flight altitude is not believed to vary with seasons (Cooper and Day 2004), although flight altitudes tend to be higher inland than at coastal locations (Cooper and Day 1998), and higher in the evening than the dawn (Day and Cooper 1995). Present-day Hawaiian petrel colonies are typically located at high elevations above 2,500 m (8,200 feet); however, seabird surveys at Hawaiʻi Volcanoes National Park have focused on Hawaiian petrels in subalpine areas between 1,825 m (6,000 feet) and 3,050 m (10,000 feet) in elevation (Swift and Burt-Toland 2009). The types of habitats used for nesting are diverse and range from xeric habitats with little or no vegetation, such as at Haleakalā National Park on Maui, to wet forests dominated by ʻōhiʼa with uluhe (*Dicranopteris linearis*) understory, such as those found on Kauaʻi (Mitchell et al. 2005). Utilized lava flows range in age from 2,000 to 8,999 years old. Despite the extensive age range, the surfaces of all nesting flows were oxidized and broken (Hu et al. 2001). A 2001 study reveals that approximately half of the nests examined are located in pāhoehoe pits that exhibited evidence of human modification. The other half are located in various naturally occurring features such as lava tubes, cracks in tumuli (fractured hills on the surface of pāhoehoe flows), spaces created by uplift of pāhoehoe slabs, and other miscellaneous nature features (Hu et al. 2001). Females lay only one egg per year, which is incubated alternately by both parents for approximately 55 days. Eggs hatch in June or July, after which both adults fly to sea to feed and return to feed the nestling. The young fledge and depart for sea in October and November. Adult birds do not breed until age 6, and may not breed every year, but pre-breeding and non-breeding birds nevertheless return to the colony each year to socialize

3.2.2. Threats

The main factors contributing to population declines of ground-nesting seabirds such as Hawaiian petrels are habitat degradation; the loss of nesting habitat; predation of eggs, hatchlings, and adults at nesting sites by introduced mammals (e.g., dogs [*Canis familiaris*], mongooses [*Herpestes javanicus*], cats [*Felis catus*], rats [*Rattus* spp.], and pigs [*Sus scrofa*]); and urban lighting and associated structures (e.g. power lines, buildings and fences) cause disorientation and fall-out of juvenile birds (Ainley et al. 1997; Mitchell et al. 2005; Hays and Conant 2007). The most serious cause of mortality and breeding failure of Hawaiian petrels is predation by introduced mammals (Simons 1985; Simons and Hodges 1998; Hodges 1994).

Introduced mammals have the potential to severely impact ground-nesting seabirds. Mongooses are abundant in low elevations, with an upper elevation limit of approximately 2,100 m (6,900 feet). As a result, they can prey on ground-nesting seabird species that nest along the coast or at low elevations (Swift and Burt-Toland 2009); mongoose may have displaced Hawaiian petrels at lower elevation breeding sites where they were once common at all elevations on all the main islands (Simons and Hodges 1998, Simons 1985). Feral cats are more widely distributed, ranging from sea level to subalpine areas, and provide a major threat to ground-nesting birds at high elevations (Hodges 1994; Winter 2003). Disorientation and fall-out as a result of light attraction are less of an issue on Hawaiʻi Island because of Hawaiʻi County's Outdoor Lighting Ordinance (Hawaiʻi County Code, Chapter 14, Article 9). The ordinance requires shielded low-pressure sodium lamps for all ground illumination, thereby minimizing upward light pollution. This greatly reduces the risk of fall-out from seabirds. Towers, power lines, and obstructions (e.g., wind turbines) are hazards to seabirds (USFWS 2005), and Hawaiian petrel fatalities resulting from striking wind turbines have been documented at Kaheawa and Auwahi Wind Farms.

3.2.3. Known Fatalities at Other Hawaiian Wind Farms

Hawaiian petrel fatalities have been documented at wind farms on Maui (Table 3.2). These birds are presumed to have collided with turbines while flying to or from their nesting colony (SWCA 2012). Mortality of Hawaiian petrels as a result of collisions with power lines, fences, and other structures near breeding sites or from attraction to bright lights has been documented (Ainley et al. 1997). Juvenile birds are sometimes grounded when they become disoriented by lights on their nocturnal first flight from inland breeding sites to the ocean (Ainley et al. 1997).

Table 3.2. Documented Fatalities of Hawaiian Petrels at Wind Farms in Hawaiʻi

Location	Observed Take	Calculated Take (80% Dalthorp)*
Auwahi Wind Farm (Maui)	1	3
Kaheawa Wind Farm (Maui)	7	20**
Kaheawa II Wind Farm (Maui)	0	0
Kahuku Wind Farm (Oʻahu)	0	0
Kawailoa Wind Farm (Oʻahu)	0	0
Pakini Nui Wind Farm (Hawaiʻi)	0	0

Sources: Sempra Energy (2015); Kaheawa Wind Power, LLC (2015a, 2015b); Kahuku Wind Power, LLC (2015); Kawailoa Wind Power, LLC (2015), Diane Sether, USFWS, pers comm 08/17/2015.

* The take estimate is based on the *Evidence of Absence Software* (Dalthorp et al. 2014), existing literature (i.e., Huso at al. 2015), and site-specific data. It includes the indirect take estimate.

**Does not include lost productivity, which is in addition to what is reported at the 80% assurance level.

3.2.4. Known Occurrences in the South Point Area

Day et al. (2003) studied the movements and distribution of Hawaiian petrels and Newell's shearwaters on the Island of Hawaiʻi using radar in 2001 and 2002. Because radar data do not identify passage rates by species and because there are no recent records of nesting Newell's shearwaters on Hawaiʻi, the most recent evidence from the Puna region being from 1993 (Reynolds and Richotte 1997), radar detections from Day et al. (2003) are understood to be primarily Hawaiian petrels. Movement rates of Hawaiian petrels on the island are generally low (0.0–3.2 targets per hour), with the exception of Waipiʻo Valley. The timing of evening movements suggested to the authors that Hawaiian petrels fly over the northern and southern parts of the island. Birds flying over the Project will have a low target rate of approximately 1–2 targets per hour, similar to what was observed at Hoʻopuloa and Punaluʻu (Day et al. 2003).

The closest known Hawaiian petrel colony is on the southwest flank of Mauna Loa within the Kahuku section of the Hawaiʻi Volcanoes National Park, approximately 21.5 km (13.4 miles) upslope from the Project (Figure 3.1) (Swift and Burt-Toland 2009). Based on the Day et al. (2003) radar data, most of the birds nesting in this colony fly inland in the southwestern and southeastern parts of the island. A few Hawaiian petrels can be expected to fly over the southern part of the Island of Hawaiʻi during their flights inland toward or seaward from these nesting colonies (Day et al. 2003).

Three other known colonies are on the southeast flank of Mauna Loa, also within the Hawaiʻi Volcanoes National Park, approximately 56.3 km (35 miles) from the project. The Park currently encompasses the largest active Hawaiian petrel colony on the Island of Hawaiʻi.

SWCA was unable to find information to support any hypothesis related to the effect of wind direction and landscape features on flight patterns of the Hawaiian petrel.

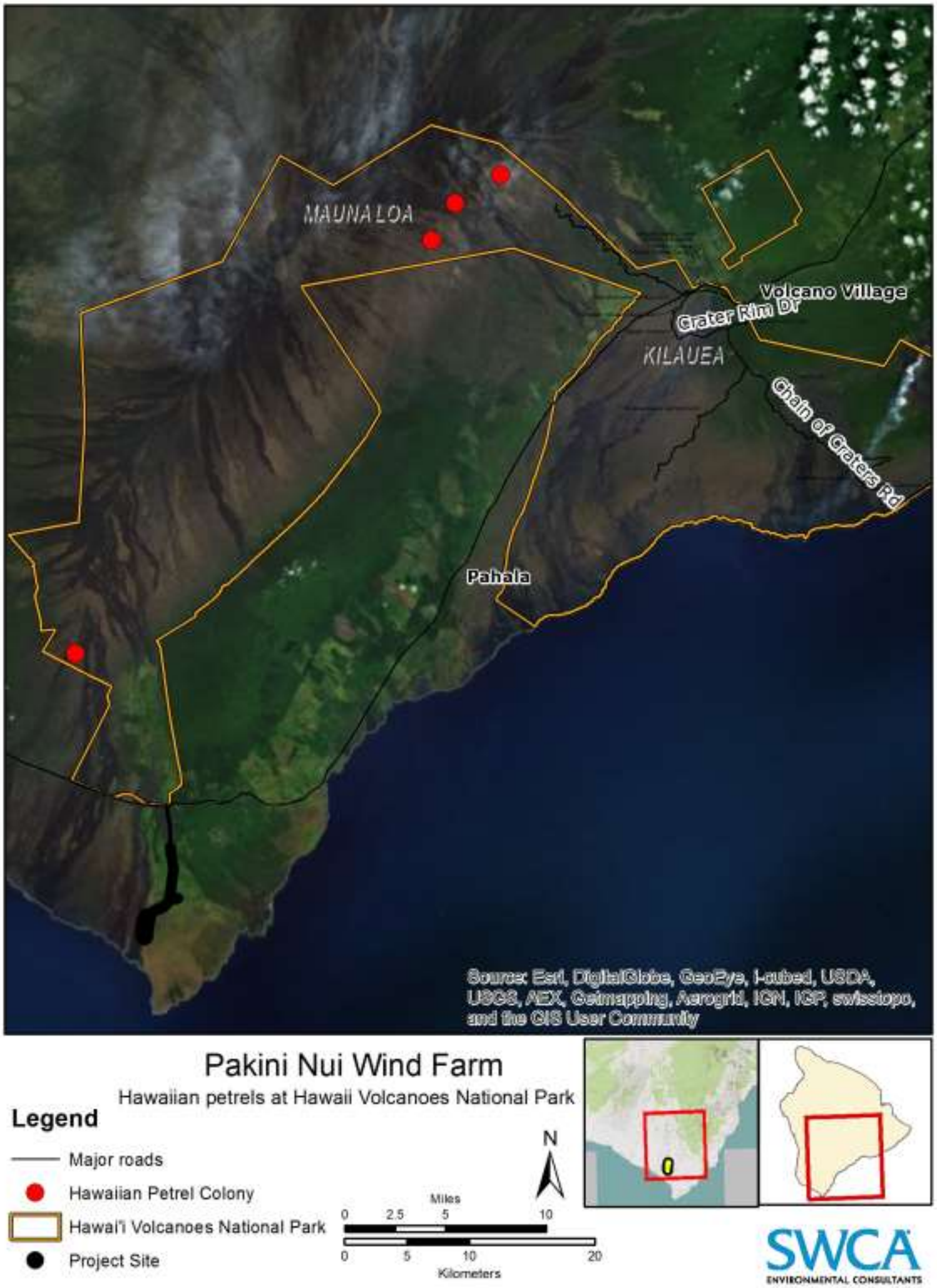

Figure 3.1. Approximate locations of Hawaiian petrel colonies in Hawai‘i Volcanoes National Park (HAVO) (from Swift and Burt-Toland 2009). The bold black line in the figure inset indicates the approximate location of Pakini Nui Wind Farm.

3.3. Band-rumped storm petrel

3.3.1. Population, Biology, and Distribution

Band-rumped storm petrels are considered the rarest breeding seabird in Hawai‘i (Banko et al. 1991; Slotterback 2002). The Hawaiian population is listed as an endangered species under the Hawai‘i State Endangered Species Act (HRS 195D-4(a)) (USFWS 2012c) and is a species proposed for federal listing species. Listing of the band-rumped storm petrel under the ESA is anticipated to occur in 2016.

The band-rumped storm petrel is a small, highly pelagic species dispersed widely around the world’s tropical and subtropical ocean regions. Breeding occurs in localized populations in several areas spread along the Atlantic and Pacific oceans. In the Pacific Ocean, breeding colonies have been documented only in the Galapagos Islands, Japan, the Hawaiian Islands, and possibly Cocos Island near Costa Rica (Pyle and Pyle 2009; USFWS 2012c). The Hawaiian population was once categorized as a distinct subspecies, but it has been included in a single taxon containing all Pacific band-rumped storm petrel populations (USFWS 2012c).

Based on fossil evidence, band-rumped storm petrels were once abundant and widespread throughout Hawai‘i. However, recent surveys only found small breeding locations on remote cliffs on Kaua‘i, a cave on Lehua Islet off Ni‘ihau, and high-elevation lava fields on the Island of Hawai‘i (Mitchell et al. 2005; USFWS 2012c). Band-rumped storm petrels have been documented vocalizing on Maui within the Haleakalā Crater, but evidence of breeding is lacking (Pyle and Pyle 2009). Kaua‘i is estimated to have between 171 and 221 breeding pairs. Worldwide population estimates are unlikely to exceed 25,000 breeding pairs (Mitchell et al. 2005).

Band-rumped storm petrels typically begin breeding sometime between their 3rd and 7th year, and individuals may live up to 20 years. Pairs produce a single egg per season. In Hawai‘i, calling birds are heard and eggs are laid between May and July, and nestlings fledge between August and November (Mitchell et al. 2005; Pyle and Pyle 2009). Breeding habits are not well documented, and nests are typically difficult to locate. Nests have been found in crevices and cracks along steep rugged cliffs and talus slopes (Pyle and Pyle 2009).

Foraging is typically done alone or in small groups, although “rafts” of the storm petrel numbering from a few to approximately 100 are observed occasionally off Kaua‘i, perhaps waiting for nightfall before returning to the breeding colony (USFWS 2012c). Band-rumped storm petrels are reported at various distances offshore in coastal waters around Kaua‘i, Ni‘ihau, and the Island of Hawai‘i. Of 39 reported sightings in Hawai‘i since 1995, 30 have been from Kaua‘i (USFWS 2012c).

3.3.2. Threats

Very little is known about breeding and threats to the band-rumped storm petrel. Introduced predators such as cats, mongooses, dogs, and barn owls (Wood et al. 2002) may be the most serious threats on land. Additional threats include habitat destruction by introduced ungulates, and disorientation by artificial lighting, especially in coastal areas, resulting in collision with structures (e.g. power lines, buildings and fences) (Banko et al. 1991), or in individuals becoming grounded (Harrison et al. 1990).

3.3.3. Known Fatalities at Other Hawaiian Wind Farms

No band-rumped storm petrel fatalities have been documented at other Hawaiian wind farms. However, birds have been reported killed by collisions with human-made objects in the Hawaiian Islands, especially when there are bright lights to attract them (Slotterback 2002).

3.3.4. Known Occurrences in the South Point Area

Vocalizations of band-rumped storm petrels were heard regularly within the Kahuku section of Hawaiʻi Volcanoes National Park during surveys (Swift and Burt-Toland 2009). The locations of the vocalizations are close to the location of the nesting Hawaiian petrel colony in that area, which is 21.5 km (13.4 miles) away from the Project. Two possible band-rumped storm petrel nest sites occur in the park: one along a rift in the Southwest Rift Zone on Mauna Loa and one in the southern portion of the Kahuku section. Since 1994, three band-rumped storm petrel carcasses have been found in the park between 2,400 m and 2,600 m (7,800 and 8,500 feet) on Mauna Loa, and one band-rumped storm petrel was caught in mist nets at 2,600 m (7,800 feet) in 2003 (Swift and Burt-Toland 2009). These data suggest that band-rumped storm petrels still breed on Mauna Loa.

Day and Cooper (2005) state that band-rumped storm petrels have been seen staging on the ocean (before flying inland to nesting colonies after dark) in the immediate vicinity of South Point (including a flock of 22 birds), and it is therefore possible that some birds fly over the Project on their way to their nesting grounds.

3.4. Nēnē

3.4.1. Population, Biology, and Distribution

The nēnē is adapted to a terrestrial and largely non-migratory lifestyle in the Hawaiian Islands, with negligible dependence on freshwater habitat. Compared to the related Canada goose (*Branta canadensis*), nēnē wings are smaller by approximately 16%, and their flight capability is comparatively weak. Nonetheless, the nēnē is capable of both inter-island and high-altitude flight (Banko et al. 1999; Miller 1937).

After nearly becoming extinct in the 1940s and 1950s, the nēnē population slowly has been rebuilt through captive-breeding programs. Wild populations of nēnē occur on Hawaiʻi, Kauaʻi, Maui, and Oahu. The population of nēnē was estimated in 2014 at 3,047 individuals, with the largest population on Kauaʻi (Jodi Charrier, USFWS, Personal Communication, March 7, 2016.). The Hawaiʻi Island population was estimated at 1,140 individuals (Jodi Charrier, USFWS, Personal Communication, March 7, 2016). Approximately 400 birds were slated to be moved from Kauaʻi to Maui, Molokaʻi, and Hawaiʻi, under an emergency declaration by then-governor Abercrombie. A significant portion of these birds has been moved to Hawaiʻi Island.

The nēnē has an extended breeding season, with eggs reported from all months except May, June, and July, although the majority of birds in the wild nest during the rainy (winter) season between October and March (Banko et al. 1999; Kear and Berger 1980). Nēnē nest on the ground in a shallow scrape in the dense shade of a shrub or other vegetation. A clutch typically contains three to five eggs, and incubation lasts for 29–31 days. The female incubates the eggs, with the male standing guard nearby, often from an elevated location. Once hatched, the young remain in the nest for 1–2 days (Banko et al. 1999). Fledging of captive birds occurs at 10–12 weeks, but wild birds may fledge later. During molt, adults are flightless for a period of 4–6 weeks. Molt occurs after hatching of eggs, such that the adults generally attain their flight feathers at about the same time as their offspring. When flightless, goslings and adults are extremely vulnerable to predators such as dogs, cats, and mongoose. From June to September, family groups join others in post-breeding aggregations (flocks), often far from nesting areas.

Nēnē occupy various habitat types ranging from beach strand, shrubland, and grassland to lava rock at elevations ranging from coastal lowlands to alpine areas (Banko 1988; Banko et al. 1999). The geese eat plant material, and the composition of their diet depends largely on the vegetative composition of their surrounding habitats. They appear to be opportunistic in their choice of food plants as long as the plants meet their nutritional demands (Banko et al. 1999; Woog and Black 2001).

3.4.2. Threats

The main factor limiting the recovery of nēnē populations is predation by introduced mammals, most notably cats, rats, and mongoose (USFWS 2004; Baker and Baker 1995). Additional threats may include predation by mammalian predators, limited access or availability of nutritional resources during breeding, anthropomorphic disturbances (including car strikes, disturbance of nesting and feeding, and fatalities at golf courses), infectious/inflammatory deseases (eg: *Toxoplasma gondii*) and toxicoses (eg: lead poisoning) (USFWS 2004 and Work et al. 2015). Breeding habitat, particularly at low elevations, may be limited (USFWS 2004).

3.4.3. Known Fatalities at Other Hawaiian Wind Farms

Fatalities of nēnē with wind turbines have been documented at wind farms on Maui. These fatalities have occurred in the Kaheawa area, where a resident population of nēnē is present year-round (SWCA 2012) (Table 3.3).

Table 3.3. Documented Total Nēnē Fatalities at Wind Farms in Hawaiʻi

Location	Observed Take*	Calculated Take (80% Dalthorp†)
Auwahi Wind Farm (Maui)	0	0
Kaheawa Wind Farm (Maui)	21	38
Kaheawa II Wind Farm (Maui)	3	8
Kahuku Wind Farm (Oʻahu)	0	0
Kawailoa Wind Farm (Oʻahu)	0	0
Pakini Nui Wind Farm (Hawaiʻi)	0	0

* Data from Kaheawa Wind Power, LLC. (2015a, 2015b); Kahuku Wind Power, LLC. (2015); Kawailoa Wind Power, LLC. (2015); and Sempra Energy. (2015).

† The take estimate is based on the *Evidence of Absence Software* (Dalthorp et al. 2014), existing literature, and site-specific data. It includes indirect take.

3.4.4. Known Occurrences in the South Point Area

In 2004, 144 nēnē were known to occur within the boundary of Hawaiʻi Volcanoes National Park (USFWS 2004). These birds are wide-ranging and may be found within the Kahuku section of the park. The range of the nēnē in the park is shown in Figure 3.2. The Project's turbines are approximately 40 km (25 miles) from this known population.

Day (2005) also mentions that there have been a few anecdotal sightings of nēnē near South Point itself. Potential nēnē feeding habitat in the form of grass seeds is present at the Project Area. If there is a temporary break in grazing in the areas surrounding the Project Area, and if buffelgrass is allowed to set seed, this may attract the nēnē to the Project vicinity. Therefore, sporadic presence of the nēnē at the Project Area can be expected; however, there is no shrubby vegetation that will attract nēnē to the Project Area for nesting. SWCA biologists surveyed six point count stations from January to December 2014, typically between 0600 and 1100, and 1400 and 1900 during each visit to the wind farm. During these surveys no nēnē were observed (SWCA 2015a).

The nēnē population on the Island of Hawai‘i is expected to expand in the coming years as nēnē from Kaua‘i are translocated to the Island of Hawai‘i and through other ongoing conservation actions. As the population expands, the nēnē will likely start to occupy more of their historical range, which includes South Point (Day 2005), and birds could be observed more frequently at the Project Area.

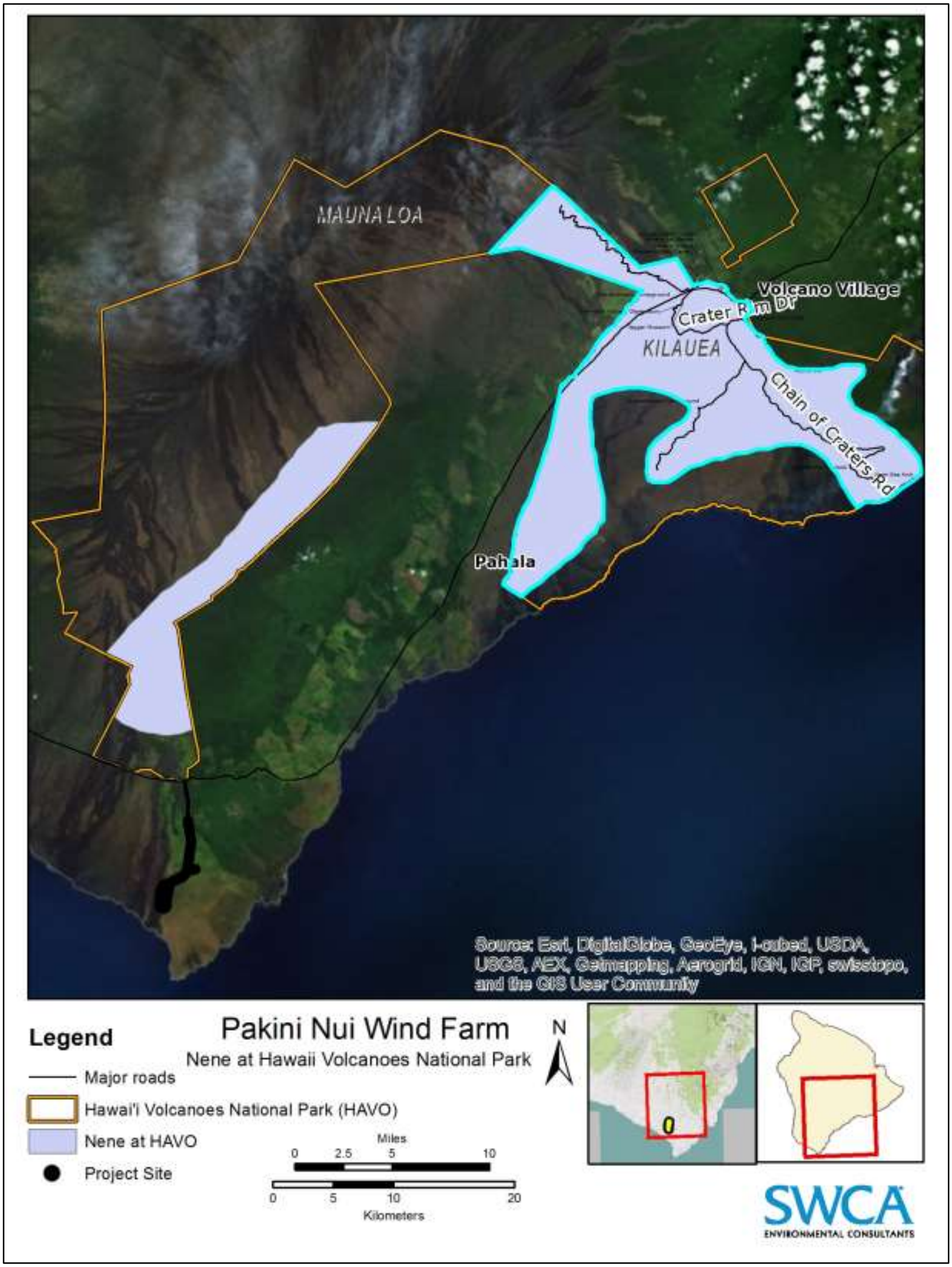

Figure 3.2. Range of nēnē at Hawai'i Volcanoes National Park (HAVO) Data sources: Pratt et al. 2011; HAVO 2012.

4. TAKE ANALYSES

The potential for wind energy turbines to cause fatalities of birds and bats is well documented in the continental United States (e.g., Erickson 2003; Horn et al. 2008; Johnson et al. 2003a, 2003b; Kerlinger and Guarnaccia 2005; Kingsley and Whittam 2007; Kunz et al. 2007). In Hawai‘i, wind-powered generation facilities are relatively new. Incidental take of listed species has been observed at each of the five wind-powered generation facilities in Hawai‘i that have incidental take authorizations. Tawhiri has conducted post-construction monitoring to document downed wildlife at the Project Area since operations began in April 2007 (SWCA 2015c).

The modes of take (resulting in death or injury to a Covered Species) with potential to occur at the Project is by collision with turbines, overhead transmission lines, or the met tower. Measures will be implemented at the Project to avoid the potential for other effects to rise to the level of take (see sections 1.2 and 6). An example is the observation of speed limits while at the Project to avoid vehicle and Covered Species strikes.

Below is the quantitative take analyses completed for each of the Covered Species, and the results of these analyses.

4.1. Hawaiian Hoary Bat

The take estimate for Hawaiian hoary bats is based on the *Evidence of Absence Software* model (Dalthorp et al. 2014), existing literature, and site-specific data. The *Evidence of Absence Software* model is more robust than others in estimating fatality rates when the number of observed fatalities is relatively low. The software uses Bayes’ formula to measure uncertainty around the actual mortality estimate, expressed as credible limits. The 80% upper credible limit, not the actual mortality, is routinely used for mitigation planning in Hawai‘i and is applied here. The take estimates are based on data from one year of searcher efficiency, and carcass persistence trials, which were collected between April 15, 2014 and April 15, 2015. Furthermore, the two observed bat fatalities, which were found two and a half years apart, were used as a basis for assumption of predicted intervals between observed fatalities during the life of the ITL/ITP. Changes in any of these parameters in future years (e.g., changes in the actual mortality or monitoring intensity) would result in a different 80% upper credible limit. Year-to-year variability of this estimate cannot be confidently predicted with just one year of data. Therefore, this HCP uses a tiered approach to estimating fatality of this species at the Project.

4.1.1. Collision Fatality Estimate

The parameters used for the *Evidence of Absence Software* model are summarized in Table 4.1. Five of the 14 turbine search areas are only partially searchable due to turbine proximity to a cliff located 40 m downwind, on average. Based on the modeling using data from Hull and Muir (2010) which indicated that 80% of bat carcasses would fall within 44.26 m of a large turbine, and conservatively assuming that all bat carcasses will fall downwind of the turbines, it is estimated that 37% of the bat fatalities around Turbines 1-5 will fall into unsearchable areas. If 63% the bat fatalities at Turbines 1-5 fall into searchable areas, and 100% of the bat fatalities at Turbines 6-14 fall into searchable areas, the searchable area for the project as a whole is 87%. That is, 87% of all bat fatalities will fall within the search area, whereas the remaining 13% will fall outside the search area, assuming the likelihood of incidental take is equal across all turbines.

Table 4.1. Parameters Used in *Evidence of Absence Software* Model for Hawaiian Hoary Bat Fatality to Model Estimated Take for Year When Take is Observed

Parameter	Current Value
Carcass count (X)	1
Sampling coverage (a)	0.87
Searcher efficiency (p)	0.67
p_{lwr}	0.56
p_{upr}	0.77
K (probability of finding a carcass on subsequent searches)	0.10
Sampling Dates	Formula
Interval (I)	7
Span	365
Persistence Distribution	Exponential
λ	0.198
Mean Carcass Persistence (CP)	5.05
CP_{lwr}	3.51
CP_{upr}	6.58
r = P (persist until a search)	0.541
Interval (Ir)	7
Prior Distribution	Uniform
Max.	200
Credibility Level (1 - α)	0.8
Arrival function	Uniform
α	N/A
β	N/A

Intensive, weekly site-specific monitoring was initiated in August 2013. Before this, less robust monthly monitoring occurred starting from COD to August 2013. This monitoring consisted of monthly searches of an area with a 150m radius around each turbine. The time spent searching around each turbine ranged from ten minutes to two hours, at a walking pace of 30-60 meters per minute. At the start of the robust monitoring, one Hawaiian hoary bat fatality was recorded on August 31, 2013. A second Hawaiian hoary bat fatality was found during routine weekly searches on March 1st, 2016. The fatality estimation assumes that when the bat fatality was found on August 31, 2013, search conditions, carcass retention (CARE), and searcher efficiency (SEEF) probabilities were representative of conditions at that time. CARE represents the amount of time a carcass, on average, stays on the ground before being removed by scavengers or otherwise disappears. SEEF is the probability that a carcass is discovered by the searcher. CARE and SEEF probabilities are not expected to vary seasonally at this site and are assumed to be constant over time for these calculations. Canine-led searches were not conducted. CARE trials consisted of 14-day-long trials in which surrogate carcasses were deployed on-site to known locations. Rats were used as surrogates for bats during the CARE trials. The use of similar-sized proxy carcasses is a common practice for listed species, and the proxies are assumed to be subject to the same scavenging rates as the carcasses of the listed species. The number of days that a rat carcass was retained was recorded visually or by game camera imaging. The mean minimum retention time of carcasses on-site was 4.82 (SD = 3.61) days, and the mean maximum retentaion time was 5.05 (SD = 3.66) days (SWCA 2015c). The Huso (2011) fatality estimator was used to model the distribution of the CARE data; the exponential distribution was selected because it produced the best fit of the four distributions tested.

SEEF trials were proctored by SWCA biologists, and searches were done independently by another SWCA biologist who was not knowledgeable of the carcasses' locations. Plastic replicas of the hoary bat were deployed for SEEF trials because rat carcasses, which are often used for SEEF trials as proxies for bats, initially didn't stay on the ground long enough for effective SEEF trials. SEEF, or the number of surrogate carcasses found divided by the total amount of surrogate carcasses deployed, was calculated, at 66.67% during the first search attempt (84 trials conducted April 2014 to April 2015,SWCA 2015c). In order to determine k (the factor by which search efficiency changes with each successive search), trial carcasses not detected during the first search attempt were left in place to determine how many would be subsequently detected. Of the carcasses remaining, 28.57% were detected the following week (k = 0.43). However, the k for plastic bats is higher than would be expected for real bats, presumably because plastic bats do not noticeably decompose in a week's time. Per the recommendation of the USFWS, the fatality estimator was run using k = 0.10 which is substantially lower and is consistent with a conservative approach to modeling. Rat carcasses will be used in SEEF trials as a surrogate for bats under this ITP/ITL, beginning at ITP/ITL approval.

Based on current data, the probability of finding a carcass at the Project Area (g), combining factors of sampling coverage and SEEF and CARE rates, is 31.7% (95% confidence interval 24.5–38.9). The *Evidence of Absence Software* model estimates that based on current Project conditions, an observed take of 1 bat translates to an actual take (observed + unobserved) of 8 bats at the 80% credibility level over the period monitored. This means we can say with 80% certainty that no more than 8 bat fatalities occurred in 1 year of operation.

The fatality estimate at the 80% credibility level is in part driven by the current carcass persistence (CP) rates. Two factors potentially can decrease this fatality estimate: either an increase in mean CP by predator trapping, or an increase in the search frequency. Scavenger trapping has been initiated at the Project Area, and from November 2014 to April 2015, a total of 7 feral cats (*Felis catus*) and 1 mongoose (*Herpestes javanicus*) were trapped. Scavenger trapping is scheduled to continue when fatality searches are conducted.

4.1.2. Indirect Effects Rising to the Level of Take

Indirect effects potentially rising to the level of take consist of the effects to dependent juveniles as a result of fatalities to adults caused by collision. Hawaiian hoary bats typically breed between April and August, and mature females produce 1.8 pups annually on average. Hawaiian hoary bats have one brood per year, only females care for dependent juveniles. Bats may be at the Project year-round, and individual female bats are expected to have dependent young for a period of 1 month, after which the young are able to fly and forage (NatureServe 2016). Therefore, the likelihood of a female bat killed anytime during the year having dependent young is 1/12 or = 8%. Consequently, the additional take resulting from indirect effects can be calculated from the annual estimate of female bat fatality as follows:

1 (proportion that is female) × 0.08 (likelihood of having dependent young) ×
1.8 (average number of young) = 0.14 juvenile per bat

If the female is lactating, then the likelihood of the female having dependent young becomes 100%. If lactation is positively determined, the additional indirect take associated with that individual will be 1.8 juveniles:

$$1 \text{ (proportion that is female)} \times 1.00 \text{ (likelihood of having dependent young)} \times 1.8 \text{ (average number of young)} = 1.8 \text{ juvenile per bat}$$

Any observed carcasses will be provided to USFWS or DOFAW so that genetic analysis can be conducted to determine the sex of the bat. Because male bats do not contribute to rearing young, there is no indirect take from male bat fatality. However, in the event that sex cannot be determined, including for unobserved take, the additional take resulting from indirect effects may be calculated from the annual estimate of bats of unknown sex as follows:

$$0.5 \text{ (proportion that is female)} \times 0.08 \text{ (likelihood of having dependent young)} \times 1.8 \text{ (average number of young)} = 0.07 \text{ juvenile per bat}$$

4.1.3. Take Estimate

A tiered approach helps to account for uncertainty in take estimates. Because the take estimate in this HCP is based on two observed fatalities, and limited SEEF and CARE data, it is unknown how fatality may vary among years. Different observed take rates were assumed to set up the tiers: one observed fatality every year, or 1 every 1.4 years, or 1 every 2.5 years, with the first observed fatality happening to be found during the first year of monitoring after ITP/ITL approval. Each tier represents the total take authorized (i.e., take is not additive among tiers). Actual take will be calculated based on the results of the compliance (i.e., fatality) monitoring. Should monitoring results indicate that the 20-year authorized take will exceed Tier 1, the mitigation for Tier 2 will be initiated; similarly, if the 20-year authorized take will exceed Tier 2, the mitigation for Tier 3 will be initiated. As such, Tier 2 mitigation will be triggered if, before year 15, 75% of the authorized take under Tier 1 has been exceeded. Similarly, Tier 3 will be triggered if, before year 15, 75% of authorized take under Tier 2 has been exceeded. The projected 20-year take estimate for the Project is 39 Hawaiian hoary bats for Tier 1, an additional 22 Hawaiian hoary bats for Tier 2, and an additional 22 for Tier 3 (Table 4.2).

The 20-year estimate of direct take was calculated using the Evidence of Absence model assuming that monitoring would be conducted weekly throughout the ITP/ITL term ($g = 0.317$).

Table 4.2. Tiered Take Estimates for Hawaiian Hoary Bats at Pakini Nui Wind Farm

Tier	SEEF/Search Area/Search Interval	Carcass Persistence	Fatality interval (years)	g (probability of finding a carcass with all factors combined)	20-Year Direct Take (80% credibility level)	20-year Assumed Indirect Take of Juveniles (80% credibility level)*	20-year Total Take Authorization
1	0.67 (current rate)	5.05 (current rate)	2.50	0.317	34	5	39
2	0.67 (current rate)	5.05 (current rate)	1.43	0.317	55	6	61
3	0.67 (current rate)	5.05 (current rate)	1.00	0.317	75	8	83

* Indirect take is calculated as 0.07 juveniles per individual direct take (assuming the sex of all fatalities is undetermined) and adding 1.8 juveniles prior to rounding to the nearest whole individual, to account for the confirmed incidental take of a lactating female Hawaiian hoary bat..

4.1.4. Impacts of the Taking

As shown in Table 4.2, the projected 20-year take estimate for the Project is 39 Hawaiian hoary bats for Tier 1, an additional 22 Hawaiian hoary bats for Tier 2, and an additional 22 for Tier 3. Hoary bats are thought to occur in the greatest numbers on the islands of Hawaiʻi and Kauaʻi (Menard 2001). Recent studies on the Island of Hawaiʻi indicate that based on acoustic data, the population there is either stable or increasing (Gorresen et al. 2013). However, no population estimates were provided. Bats on the Island of Hawaiʻi were habitat generalists and occurred from sea level to the highest peaks on the island (Gorresen et al. 2013). The Hawaiian hoary bat is reproductively mature at 1 year of age, and a female Hawaiian hoary bat produces on average 1.8 pups a year. If take were to be equally distributed across the life of the ITP/ITL (i.e., 1.95–4.15 individual takes per year), it will take the offspring of approximately 1–3 reproductively active female each year to replace the lost individuals. However, this is a replacement of lost individuals and not a net increase. In the absence of the proposed taking a net increase may occur if all other variables remain unchanged. However, the proposed mitigation (section 6.2) is designed to contribute to preventing the degradation, and improving the quality, of native bat foraging and roosting habitat. Mitigation measures both 1) compensate for impacts of the taking and 2) provide additional mitigation, resulting in an overall net conservation benefit for the Hawaiian hoary bat (see section 6.2).

4.2. Hawaiian Petrel

The incidental take estimate for Hawaiian petrels is calculated using existing radar data from studies conducted near South Point, which constitute the best available scientific data. The passage rates from these studies are used to model the expected fatality rates at the Project. Because the radar data do not identify passage rates by species, the collision fatality estimate of band-rumped storm petrels is included in the calculations and reasoning used for the Hawaiian petrel. However, a separate take request is included for the band-rumped storm petrel.

4.2.1. Collision Fatality Estimate

The best available data from radar surveys was used to estimate potential collision fatality rates. Because of the nocturnal nature of inland movements of Hawaiian petrels, an effective way to determine passage rates is by using radar surveys. Radar surveys are useful in areas with relatively high seabird passage rates. However, seabirds, including the Hawaiian petrel, have very limited distribution and abundance on the Island of Hawaiʻi (Ainley et al. 1997; Reynolds et al. 1997; Simons and Hodges 1998; Day et al. 2003). During radar surveys in 2001 and 2002, Day et al. (2003) recorded very low numbers of seabirds (0.0–3.2 targets per hour) flying inland at all sites sampled, with the exception of Waipiʻo Valley. Limitations of use of radar surveys to determine seabird passage rates include the inability to distinguish between seabird species. Very few, and often none of the targets are visually observed and identified to species. In addition, other birds are similar to Hawaiian petrels in size and flight speed, resulting in target contamination. This results in a positive bias in passage rates. Species that artificially may inflate passage rates include sooty terns (*Onychoprion fuscatus*), mallard-Hawaiian duck hybrids (*Anas wyvilliana* x *platyrhynchos*), Pacific golden-plovers (*Pluvialis fulva*) and the band-rumped storm petrel. In addition, there are no recent records of nesting Newell's shearwaters on the Island of Hawaiʻi, and this species is not considered to be at risk of collision with project components.

Although population viability analyses suggest that the Mauna Loa breeding population of Hawaiian petrels may not persist (Hu et al. 2001), Hawaiian petrel breeding colonies where predator control is implemented at Hawaiʻi Volcanoes National Park appear fairly stable over the past few years (National Park Service [NPS] 2010, 2011, 2012). Birds outside of this somewhat protected area are likely exposed to higher levels of predation, in particular by cats (Simons 1985; Natividad Hodges 1994; Winter 2003). Therefore, it is reasonable to assume that the Island of Hawaiʻi breeding population of Hawaiian petrels is either stable or decreasing, and the Day et al. (2003) and the more recent Hamer (2008a and b) data represent an accurate or conservative proxy for 2014 passage rates for the Hawaiian petrel. The average passage rates of the two nearest radar sites were used for analyses in this HCP.

The two locations closest to the Project Area at which Day et al. (2003) collected radar data in 2001 and 2002 are Hoʻopuloa and Punaluʻu, located approximately 32 km (20 miles) northwest and 25 km (16 miles) northeast of the Project, respectively. At Hoʻopuloa, the average passage rate in May–June of 2001 and 2002 was 1.2 targets per hour, and at Punaluʻu, the passage rate was 1.6 targets per hour (mean = 1.4 targets per hour). Because radar data do not distinguish seabird species, it is assumed that the Day et al (2003) passage rates include Hawaiian petrels and band-rumped storm petrels. Day and Cooper (2003) performed a 5-day survey near the Manuka State Wayside Park in July 2003, and recorded only one seabird target during 5 days of radar sampling. More recently, radar surveys in fall and spring 2008 approximately 2 miles north of Pakini Nui Wind Farm resulted in the detection of 3 and 20 targets, respectively, each during 5 days of sampling (Hamer 2008a, 2008b). The passage rate during this study was much lower than those recorded at Hoʻopuloa and Punaluʻu in 2003 by Day et al. (2003). During the Hamer (2008a, 2008b) studies, the average flight altitude was 312.55 m above ground level. None of the targets flew below 132.44 m above ground level, and therefore none of these targets would have flown within the altitude of the Project's rotor swept zone.

Based on a passage rate of 1.4 targets per hour per 1.5-km-radius sample area, on average 0.21 Hawaiian petrels fly in the space occupied by each turbine per year (Table 4.3), and 0.00 Hawaiian petrels fly in the space occupied by the met tower each year (Table 4.5). Hawaiian petrels are adapted to nocturnal flight and are able to navigate forests near their nests under low-light conditions. Evidence suggests that Hawaiian petrels are highly capable of avoiding vertical structures under low-light conditions, resulting in high avoidance rates (Cooper and Day 1998; Tetra Tech 2008; KWP 2009, 2010). Based on avoidance rates of 95% and 99% from collision with Project turbines or the met tower, annual fatality rates of Hawaiian petrels range from 0.022 to 0.004 fatality per year (Tables 4.4 through 4.7).

The best available existing data on the Island of Hawaiʻi were used to estimate seabird passage rates and fatality estimates for the ITP/ITL term. Because the radar data do not identify passage rates by species, Hawaiian petrels and band-rumped storm petrels are included in the calculations and reasoning for the collision fatality estimate.

Table 4.3. Estimated Average Exposure Rates and Fatality Rates of Hawaiian Petrels and Band-Rumped Storm Petrels for the 1.5-MW GE Turbines Rotor Swept Zone at Pakini Nui Wind Farm

Variable		
	Movement Rate	
A	Mean movement rate (birds/hour/ha)	0.001980198
B	Daily movement rate (birds/day/ha) A × 5	0.00990099
C	Fatality domain (days)	210
D	Annual movement rate (birds/year) B × C	2.079207921
E	Proportion birds flying within rotor swept zone	0.25
F	Annual movement rate within rotor swept zone D × E	0.51980198
	Horizontal Interaction Probability	
G	Volume occupied by rotor swept zone (m^3)	356637.0133
H	Volume of a 1-ha area from minimum to maximum rotor height (m^3)	880000
I	Horizontal interaction probability G ÷ H	0.405269333
	Exposure Index	
J	Daily exposure index (birds/rotor swept zone/day) B × E × I	0.001003142
K	Annual exposure index (birds/rotor swept zone/year) F × I	0.210659802
	Fatality Probability	
L	Probability of striking a blade on frontal approach	0.146664833
M	Probability of fatality if striking blade	1
N	Probability of fatality if an interaction on frontal approach L × M	0.146664833
	Fatality Index	
O	Annual fatality rate with 90% exhibiting collision avoidance (birds/turbine/year) K × N × 0.1	0.003089638
P	Annual fatality rate with 95% exhibiting collision avoidance (birds/turbine/year) K × N × 0.05	0.001544819
Q	Annual fatality rate with 99% exhibiting collision avoidance (birds/turbine/year) K × N × 0.01	0.000308964

Table 4.4. Estimated Average Exposure Rates and Fatality Rates of Hawaiian petrels and Band-Rumped Storm Petrels for the 1.5-MW GE Turbines Tubular Tower at Pakini Nui Wind Farm

Variable		
	Movement Rate	
A	Mean movement rate (birds/hour/ha)	0.001980198
B	Daily movement rate (birds/day/ha) A × 12	0.00990099
C	Fatality domain (days)	210
D	Annual movement rate (birds/year/ha) B × C	2.079207921
	Probability of a 1-ha plot with a turbine	0.5
E	Proportion birds below rotor swept zone	0.25
F	Annual movement rate below rotor swept zone D × E	0.25990099
	Horizontal Interaction Probability	
G	Volume occupied by tubular tower (m^3)	942
H	Volume of 1-ha area below hub	750000
I	Horizontal interaction probability G ÷ H	0.001256
	Exposure Index	
J	Daily exposure index (birds/tubular tower/day) B × E × I	3.10891E-06
K	Annual exposure index (birds/tubular tower/year) F × I	0.000326436
	Fatality Probability	
L	Probability of striking a tubular tower if in airspace	1
M	Probability of fatality if striking tubular tower	0.95
N	Probability of fatality upon interaction L × M	1
	Fatality Index	
O	Annual fatality rate with 90% exhibiting collision avoidance (birds/tower/year) K × N × 0.1	3.26436E-05
P	Annual fatality rate with 95% exhibiting collision avoidance (birds/tower/year) K × N × 0.05	1.63218E-05
Q	Annual fatality rate with 99% exhibiting collision avoidance (birds/tower/year) K × N × 0.01	0.0000032644

Table 4.5. Estimated Average Exposure Rates and Fatality Rates of Hawaiian Petrels and Band-Rumped Storm Petrels for the Met Tower at Pakini Nui Wind Farm

Variable		
	Movement Rate	
A	Mean movement rate (birds/hour/ha)	0.001980198
B	Daily movement rate (birds/day/ha) A × 12	0.00990099
C	Fatality domain (days)	210
D	Annual movement rate (birds/year) B × C	2.079207921
E	Proportion birds below meteorological tower (< 60 m)	0.25
F	Annual movement rate below meteorological tower (< 60 m) D × E	0.51980198
	Horizontal Interaction Probability	
G	Volume occupied by meteorological tower (m^3)	420.1840223
H	Volume of 1-ha area meteorological tower (< 80 m) (m^3)	800000
I	Horizontal interaction probability G ÷ H	5.25E-04
	Exposure Index	
J	Daily exposure index (birds/tower/day) B × E × I	1.30E-06
K	Annual exposure index (birds/tower/year) F × I	2.73E-04
	Fatality Probability	
L	Probability of striking a met tower if in airspace	1
M	Probability of fatality if striking tubular tower	1
N	Probability of fatality upon interaction L × M	1
	Fatality index	
O	Annual fatality rate with 90% exhibiting collision avoidance (birds/tubular tower/year) M × P × 0.05	2.73016E-05
P	Annual fatality rate with 95% exhibiting collision avoidance (birds/tubular tower/year) M × P × 0.05	1.36508E-05
Q	Annual fatality rate with 99% exhibiting collision avoidance (birds/tubular tower/year) M × P × 0.01	0.0000027302

Table 4.6. Combined fatality estimates for Hawaiian Petrel and Band-Rumped Storm Petrels at Pakini Nui Wind Farm.

	Turbine (n = 14)	Met Tower	Total Fatality	20-year Fatality Estimate
Annual fatality rate with 90% exhibiting collision avoidance (birds/year)	0.04371	0.00003	0.04374	0.8748
Annual fatality rate with 95% exhibiting collision avoidance (birds/year)	0.02186	0.00001	0.02187	0.4374
Annual fatality rate with 99% exhibiting collision avoidance (birds/year)	0.00437	0.00000	0.00437	0.0874

There is a growing body of evidence that collision avoidance of Hawaiian petrels is close to 99% (Sanzenbacher and Cooper 2013); therefore, a range of 95%– 99% avoidance rate is used here for the fatality estimate. The 20-year combined fatality estimate of Hawaiian petrels for the Project is between 0.087 and 0.437 for 99% and 95% avoidance rates, respectively (see Table 4.6). Therefore, it is unlikely that a fatality will be detected during 20 years of operation. To cover for the stochastic event of an incidental take of Hawaiian petrels, the direct take is two Hawaiian petrels.

Although there is potential for any avian species to collide with power lines, the possibility of Hawaiian petrels colliding with overhead lines at the Project Area is considered remote. Recent monitoring of bird strikes at power lines on Kaua‘i indicate that the occurrence of seabird collisions with some power lines is significantly higher than previously reported (Travers et al. 2014). On Kaua‘i, take of Newell’s shearwater (a seabird with similar flight behavior) associated with 1,843 km (1,145 miles) of transmission, distribution, and secondary lines in 2008 was estimated to be 15.5 breeding adults and 63 non-breeding or immature individuals (Planning Solutions et al. 2010). Kaua‘i is estimated to host 75% of the total population of Newell’s shearwater population, which was estimated to be 21,250 breeding and non-breeding birds in 2008 (Planning Solutions et al. 2010). This amounts to 0.067 fatality per year per 1 mile of power line. The populations of inland nesting seabirds on south Hawai‘i are much smaller than those on Kaua‘i. With a Hawaiian petrel population of approximately 100–200 breeding pairs on the Island of Hawai‘i (Pyle and Pyle 2009), collision rates with overhead power lines are expected to be much lower on the Island of Hawai‘i than estimated for Kaua‘i, and for the Project, the collision incidence is expected to be discountable.

Flight height data from nearby (approximately 5.5 miles) radar surveys in 2008 (Hamer 2008a, 2008b) show that the average flight altitude of seabird targets was 312.55 m (1,025 feet) above ground level. None of the targets flew below 132.44 m (435 feet) above ground level; therefore, none of these targets would have flown within the altitude of the Project’s tie-line, or rotor swept zone.

Much of the underreporting of seabird collisions with power lines on Kaua‘i is due to the fact that very few seabirds fall directly to the ground after colliding with power lines. This indicates that ground searches are not an effective method to document fatalities resulting from power line collisions. However, only 7% of the observed power line strikes resulted in a documented downed bird; therefore, the exact impacts of power line collisions are not well-understood. This monitoring effort also showed significant variations of strike rates between different sections of power line. The highest strike rates were associated with particular areas on Kaua‘i, with power lines at higher altitudes, and with lines that stood the highest above the local topography and vegetation (Travers et al. 2014).

4.2.2. Indirect Effects Rising to the Level of Take

Adult and immature Hawaiian petrels have the potential to collide with turbines and met towers while moving between nesting and feeding grounds during the pre-laying period (March–April) and breeding, incubation, and chick-feeding period (May–October). The risk of collision outside the pre-laying period or breeding season (November–February) is considered negligible because Hawaiian petrels do not return to land, and therefore will not be passing through the Project during this period.

Take of an adult bird during the breeding, incubation, and chick-feeding period (May–October) could result in indirect effects to eggs or chicks if present. Effects could include the total loss of eggs or chicks, which would rise to the level of take. Survivability of offspring following take of 1 parent is dependent on the time of year during which the parent is lost. Both Hawaiian petrel parents alternate incubating the egg (May–July), allowing the other to leave the colony to feed. Therefore, during the incubation period, it is expected that both parents are essential for the successful hatching of the egg (Simons 1985). Both parents also contribute to feeding the chicks. Chicks are fed 95% of the total food they will receive from their parents within 90 days of hatching (Simons 1985). Because hatching generally occurs in late June, chicks should have received 95% of their food by the end of September. After September, it is likely that chicks could fledge successfully without further parental care because chicks have been documented as abandoned by their parents up to 3 weeks before successful fledging (Simons 1985). Consequently, it is considered probable that after the initial 90 days of parental care, chicks also are capable of fledging if care was provided by only one parent. Therefore, for purposes of this HCP, both parents are considered essential to the survival of a Hawaiian petrel chick through September, after which a chick has a 50% chance of fledging successfully if adult take occurs (in October).

Not all adult Hawaiian petrels visiting a nesting colony breed every year. Simons (1985) found that 11% of breeding-age females at nesting colonies were not breeding. Eggs are laid and incubated between May and July, and an average of 74% of eggs hatch successfully (Simons 1985). Therefore, there is an 89% chance (100% - 11% = 89%) that an adult petrel taken from May through June was actually breeding or incubating and a 66% (0.89 × 0.74 = 0.66) chance in July and August that the individual successfully had produced a chick. Most non-breeding birds and failed breeders leave the colony for the season by mid-August (Simons 1985). Therefore, there is nearly a 100% chance that birds taken in September or October are likely to be young fledglings. Based on the above life history parameters and as identified in Table 4.7, indirect effects rising to the level of take (loss of eggs or chicks) will be assessed at a rate of 0.89 egg per adult taken between May and July; 0.66 chick per adult in August; 1.00 chick per adult taken in September; and 0.50 chick per adult taken in October.

Table 4.7. Calculation of Indirect Take for Hawaiian Petrel

Hawaiian Petrel	Season	Average no. of Chicks per Pair (A)	Likelihood of Breeding (B)	Parental Contribution (C)	Indirect Take (A × B × C)
Adult	March–April	–	0.00	–	0
Adult	May–July	1	0.89	1.0	0.89 egg
Adult	August	1	0.66	1.0	0.66 chick
Adult	September	1	1.00	1.0	1.00 chick
Adult	October	1	1.00	0.5	0.50 chick
Adult	November–April	–	0.00	–	0
Immature	All year	–	0.00	–	0

For the actual take (observed and unobserved) of 2 birds, an indirect take of 1 egg/chick will be added to the total take request, for a take request of 3 Hawaiian petrels (see section 4.2.3).

4.2.3. Take Estimate

The 20-year fatality estimate of Hawaiian petrels for the Project is between 0.087 and 0.437 for 99% and 95% avoidance rates, respectively (see Table 4.6). Therefore, it is unlikely that a fatality will be detected during 20 years of operation for either species. However, to cover for the stochastic event of an incidental take of Hawaiian petrels, and allowing for unobserved direct take, the authorized take is based on the direct take of two Hawaiian petrels. The indirect take is one egg/chick; therefore, the total authorized take is three Hawaiian petrels.

4.2.4. Impacts of the Taking

The possible take of 3 Hawaiian petrels over the 20-year life of the ITP/ITL will not have a population-level effect on the species. Mitigation measures both 1) compensate for impacts of the taking, and 2) provide additional mitigation resulting in an overall net conservation benefit for the species (section 6.3).

4.3. Band-rumped storm petrel

4.3.1. Collision Fatality Estimate

Band-rumped storm petrels are the rarest breeding seabird in Hawaiʻi (Banko et al. 1991; Slotterback 2002), and most of the Hawaiian population is thought to breed only on Kauaʻi (USFWS 2012c). Because the radar data do not identify passage rates by species, the collision fatality estimate of band-rumped storm petrels is included in the calculations and reasoning used for the Hawaiian petrel (see section 4.2). There is a degree of uncertainty regarding the very low passage rates on or near the Project because there is a very little known regarding distribution and abundance of band-rumped storm petrels on the Island of Hawaiʻi (Reynolds and Cooper 1997; Slotterback 2002).

The combined band-rumped storm petrel and Hawaiian petrel 20-year fatality estimate for the Project is between 0.087 and 0.437 for 99% and 95% avoidance rates, respectively (see Table 4.6). Based on best available data on breeding populations of Hawaiian petrels and band-rumped storm petrels, it is reasonable to assume that of the seabirds passing through the Project airspace, the band-rumped storm petrel is the rarer of the two species. Therefore, the fatality estimate for band-rumped storm petrels will be considerably lower than the fatality estimates for both species combined. Therefore, it is unlikely that a band-rumped storm petrel fatality will be detected during 20 years of operation. The assumption of one documented fatality during the ITP/ITL duration is the basis for the take request for the purpose of this HCP. The take of 1 individual is statistically unlikely but possible. As with the Hawaiian petrel, allowing for unobserved direct take, the total requested direct take is two band-rumped storm petrels.

4.3.2. Indirect Effects Rising to the Level of Take

Adult and immature band-rumped storm petrels have the potential to collide with turbines and met towers while moving between nesting and feeding grounds during the breeding, incubation, chick-feeding period, and during the fledgling seasons from March to October (USFWS 2005a). The risk of collision outside this period (November–February) is considered negligible because band-rumped storm petrels do not return to land, and therefore will not be passing through the Project during this period.

Take of an adult bird during the breeding, incubation, and chick-feeding period (March–October) could result in indirect effects to eggs or chicks if present. Because the band-rumped storm petrel’s breeding biology is similar to the Hawaiian petrel, the same calculations were used for the amount of indirect take expected (see Table 4.6). Therefore, for the actual take (observed and unobserved) of two band-rumped storm petrels, an indirect take of one egg/chick will be added to the total take request, for a take request of three birds.

4.3.3. Take Estimate

The 20-year combined fatality estimate of Hawaiian petrels and band-rumped storm petrels for the Project is between 0.087 and 0.437 for 99% and 95% avoidance rates, respectively (see Table 4.6). Therefore, it is unlikely that a fatality will be detected during 20 years of operation for either species. To cover for the stochastic event of an incidental take of band-rumped storm petrels, the direct take is two band-rumped storm petrels. With indirect take of one egg/chick, the total authorized take is three band-rumped storm petrels.

4.3.4. Impacts of the Taking

The possible take of three band-rumped storm petrels over the 20-year life of the ITP/ITL will not have a population-level effect on the species. Mitigation measures both 1) compensate for impacts of the taking and 2) provide additional mitigation resulting in an overall net conservation benefit for the species (section 6.4).

4.4. Nēnē

4.4.1. Collision Fatality Estimate

Most nēnē on Hawai‘i Island are known to occur in Hawai‘i Volcanoes National Park (USFWS 2004). These birds are wide-ranging and may be found in the Kahuku section of the park, the southern boundary of which is approximately 40 km (25 miles) from the turbine string at the Project.

SWCA was unable to find any recent reports of nēnē in the South Point area, and during 12 months of avian surveys, no nēnē were observed at or near the Project. Potential nēnē feeding habitat in the form of grass seeds is present at the Project Area. Furthermore, abundant foraging habitat in not limited at the Project Area and occurs adjacent to the Project Area throughout the South Point area. If there is a temporary break in grazing near the Project Area, and if buffelgrass is allowed to set seed, this may attract nēnē to the Project Area vicinity. Therefore, sporadic presence of nēnē can be expected in the Project Area. Additionally, the population on the Island of Hawai‘i is expected to expand in the coming years as nēnē from Kaua‘i are translocated to the Island of Hawai‘i. As the population expands, nēnē likely will start to occupy more of their historical range, which includes South Point (Day and Cooper 2005), and birds could be observed more frequently in the Project Area. The USFWS therefore recommends that although no nēnē have been seen in the Project Area (SWCA 2015a), nēnē will be included as a Covered Species (personal communication, Charrier, USFWS, February 20, 2014).

It is assumed that adult nēnē are most likely to collide with turbines and the met tower during the non-breeding period (May–July) or at the end of the breeding period (breeding season is August–April) when adults and young may travel as family groups. Nēnē are highly territorial during the breeding season (Banko et al. 1999), and males are likely to defend nesting territories while females are incubating. Upon hatching, both parents attend to heavily dependent young. Adult nēnē also molt while in the latter part of their breeding period and are therefore flightless for 4–6 weeks (USFWS 2004). These adults attain their flight feathers at about the same time as their goslings (USFWS 2004). Consequently, such birds are more likely to be in flight within the Project Area only when goslings already have fledged.

Considering the low risk of incidental take of nēnē at the Project, the take estimate attributed to direct take is two nēnē.

4.4.2. Indirect Effects Rising to the Level of Take

Indirect effects rising to the level of take include loss of dependent young as a result of adult fatalities. This take will be assessed for adult nēnē only when the mortality occurs during the breeding season (August–April). Adults found during October–March will be assumed to have had a 60% chance of having been actively breeding because 60% of the population has been recorded to breed in any given year (Banko et al. 1999). Adult nēnē mortality that occurs outside the peak breeding season (April, August, and September) will be assumed to have had a 25% chance of breeding. Male and female nēnē care for their young fairly equally; therefore, take of dependent young will be assessed equally to the take of any adult male or female nēnē take observed during the breeding season. Because breeding nēnē are not expected to collide with wind turbines before the fledging of their young, the number of young possibly affected by loss of an adult is based on the average number of fledglings produced per pair (studies indicate that average number of fledglings produced annually per pair of nēnē is 0.3 [Hu 1998]).

Based on these assumptions, the additional take by loss of dependent young that will be assessed for each take (fatality) of an adult nēnē during October–March is 0.09 (Table 4.8). The amount of additional take by loss of a dependent young that will be assessed for each actual take (fatality) of an adult nēnē during the remainder of the breeding season is 0.04.

Table 4.8. Calculation of Indirect Take of Nēnē

Nēnē	Season	No. of Fledglings per Pair (A)	Likelihood of Breeding (B)	Parental Contribution (C)	Indirect Take (A × B × C)
Adult, any gender	October–March	0.3	0.60	0.5	0.09
Adult, any gender	April, August, and September	0.3	0.25	0.5	0.04
Adult, any gender	May–July	–	0.00	–	0.00
Immature	All year	–	0.00	–	0.00

For purposes of this HCP, it is assumed that all birds taken, including "unobserved take," will be adults. Because nēnē could be flying through the Project Area at any time of year, the likelihood of a nēnē being taken in breeding condition is 37.5% based on a breeding period of 4.5 months (a 1-month incubation period followed by parental care for 3.5 months; 4.5/12 = 0.375).

Following Table 4.8, take will be calculated in addition to nēnē lost through observed and unobserved take at the rate of 0.06 fledgling/nēnē (0.3000 × 0.3750 × 0.5000 = 0.0563). The total indirect take for 2 nēnē is 0.12 fledgling, which is rounded up to 1.

4.4.3. Take Estimate

The total authorized take is 3 nēnē.

4.4.4. Impacts of the Taking

The possible take of 3 nēnē over the 20-year life of the ITP/ITL will not have a population-level effect on the species. Mitigation measures both 1) compensate for impacts of the taking and 2) provide additional mitigation resulting in an overall net conservation benefit for the species (section 6.5).

5. BIOLOGICAL GOALS AND OBJECTIVES

The 2000 HCP Handbook Addendum defines biological goals as the broad, guiding principles that clarify the purpose and direction of the conservation components of an HCP (65 *Fed. Reg.* 35,241 (June 1, 2000). The following biological goals and objectives are designed to address the anticipated impacts of the incidental take resulting from the covered activities, and to consider the overall conservation needs of the Covered Species and their habitat. Minimization and mitigation measures identified in this HCP apply best available science and provide the means for achieving these biological goals and objectives, which are described below.

Goal 1. Result in net conservation benefit for Hawaiian hoary bats.

Objective 1a. Restore existing but degraded habitat for increased use by Hawaiian hoary bats through implementation of a habitat restoration project at the Kahuku Unit of Hawaii Volcanoes National Park at a scale commensurate with the authorized take.

Goal 2. Result in net conservation benefit for Hawaiian storm petrel and band-rumped storm petrel.

Objective 2a. Protect existing habitat for Hawaiian petrels and band-rumped storm petrels by contributing to a predator fence which will keep out introduced ungulates that cause harm to nesting habitat for both of these seabird species on Mauna Loa.

Objective 2b. Protect existing populations of Hawaiian petrel and band-rumped storm petrels, through contributing to efforts to fence out and trap cats, which have substantial negative impacts on the survival and reproductive success of both of these seabird species. The population to be protected is located on Mauna Loa in Hawaiʻi Volcanoes National Park.

Goal 4. Result in net conservation benefit for nēnē.

Objective 4a. Protect existing population of nēnē through predator control measures, by contributing to predator control measures at or near nesting sites on the Island of Hawaiʻi, based on project needs identified by DLNR.

Objective 4b. Protect existing but degraded habitat for increased use by nēnē by contributing to habitat protection projects carried out or identified by DLNR on the Island of Hawaiʻi.

Goal 5. Increase knowledge.

Objective 5a. Increase the knowledge and understanding of Covered Species by monitoring and sharing data with USFWS and DLNR during the ITP/ITL term at the Project Area, the bat mitigation site at the Kahuku Unit, the petrel mitigation site on Mauna Loa, and the nēnē mitigation site(s).

6. MINIMIZATION AND MITIGATION

6.1. General Measures

Measures intended to avoid or minimize the likelihood of take of bat and avian species at wind farms often are related to the development (e.g., siting) and construction (e.g., seasonality) phases of a wind farm. Such measures are not applicable at an operational wind farm such as the Project.

Minimization measures implemented at the Project Area and intended to decrease the risk of take to Covered Species are as follows.

- Minimize nighttime activities to avoid the use of lighting that could attract Hawaiian petrels, band-rumped storm petrels, and possibly Hawaiian hoary bats.
- Minimize use of on-site lighting at buildings. Use shielded fixtures for all lighting during the infrequent occasions when workers are in the Project Area at night. Outdoor lighting will be fully shielded. Outdoor lights will be restricted to what are needed for safety reasons, and will only be used in emergency situations. Otherwise, no nighttime activities will occur on-site.
- Observe a speed limit of 40 km (25 miles) per hour while driving within the Project Area. This will help minimize collision with Covered Species, in the event they are using habitat on-site or are injured. If nēnē are observed at or near the site, a speed limit of 25 km (15 miles) per hour will be observed.
- Avoid use of barbed wire top strand within the leased Project Area to reduce or eliminate the possibility of entangling Hawaiian hoary bats.
- Refrain from purposely approaching and maintain a distance (by foot or vehicle) of 30 m (100 feet) from nēnē when present in the Project Area in order to avoid erratic flight behavior that may increase strike risk.
- Year around low wind speed curtailment, as described in section 6.2, below.
- Minimize open water that may attract nēnē.

6.2. Hawaiian Hoary Bat

One operational measure being used at wind farms where native populations of bats reside, and that may help minimize Hawaiian hoary bat fatalities, is to increase the turbine cut-in speed to 5.0 m (16.4 feet) per second. Available data indicate that bat fatalities most commonly occur during lower wind speeds (Arnett et al. 2011; Arnett et al. 2013). Therefore, applying brakes to the turbines or allowing them to freewheel at less than 5.0 m (16.4 feet) per second may reduce the risk of fatality to bats. This measure has been implemented at wind farms in Hawaiʻi to reduce fatalities of Hawaiian hoary bats.

The Project implemented an interim curtailment program in March 2014 as a precaution to minimize risk of take of a Hawaiian hoary bat until an HCP and ITP/ITL could be put in place. The project currently curtails turbines between the hours of 6:00/6:30 p.m. (approximately 1 hour before civil sunset) and 6:30/7:00 a.m. (approximately 1 hour after civil sunrise). Turbines shut down if the 10-minute average wind speed is 5.0 m (16 feet) per second or less (cut-out wind speed) and will start back up if the 10-minute average wind speed is greater than or equal to 5.5 m (18.0 feet) per second (cut-in wind speed).

Data collected during a full year of acoustic monitoring in 2014 show a very strong seasonal pattern of Hawaiian hoary bat activity levels in the Project Area (SWCA 2015b). Hawaiian hoary bat activity levels in the Project Area were low during the months of November through July, with a pronounced increase in activity levels between August and October; indicating that Hawaiian hoary bats are most likely to be struck by a turbine blade in the months of August through October. However, despite the strong seasonal nature of bat activity at the Project, the risk of bats colliding with turbine blades is considered to be present year round, and Tawhiri will implement year-round low wind speed curtailment after ITP/ITL issuance. Low wind speed curtailment will consist of operating turbines at individually automated cut-out speed of 5.0 m (16.4 feet) per second, and cut-in speed of 5.5 m (18.0 feet) per second, between the hours of 6:00/6:30 p.m. (approximately 1 hour before civil sunset) and 6:30/7:00 a.m. (approximately 1 hour after civil sunrise). The turbines are curtailed on an individual basis as determined by on-board turbine anemometry. When off-line, blades are pitched to 83 degrees parallel to the wind, which allows rotors to freewheel so that bearing damage is not incurred. Rotational speeds at these wind speeds are less than can be measured with the installed equipment (< 0.1 revolutions per minute). Note that this is not the same as "pitching" blades to slow down rotor speeds. The turbines at the Project Area are unable to pitch blades sufficiently to significantly slow rotor rotation to speeds below those experienced prior to normal shut down because of insufficient wind speeds.

USFWS and DOFAW recommended that mitigation be conducted at a rate of 8 ha (20 acres) per bat, based on the approximate median core range sizes reported by Bonaccorso (2011) and Bonaccorso et al. (2015). However, recently the recommendation has been changed to 16 ha (40 acres) per bat (DLNR 2015). Because of the paucity of information regarding Hawaiian hoary bat population size, habitat use, and limiting factors, USFWS and DOFAW have recommended that mitigation for this species consist of a habitat management component and a research component (DLNR 2015). USFWS and DOFAW have added that the aggregate cost of mitigation for this species should be $50,000 per bat. To meet these requirements, Tawhiri proposes a minimization and mitigation program which includes both habitat restoration and research at an aggregate cost of $50,000 per bat.

6.2.1. Habitat management

The restoration component will be completed in partnership with NPS. The NPS has developed a complete plan to restore 162 ha (400 acres) across two areas of lowland mesic-wet ‘ōhi’a forest in the Kahuku Unit of the Hawai‘i (Appendix A). This forest restoration is expected to benefit the Hawaiian hoary bat and numerous other wildlife species (Appendix A, Table 1). The plan in its entirety is found in Appendix A. Tawhiri will assure restoration of an area commensurate with the level of take to be compensated with the restoration component over 20 years.

The official mission of NPS is to "preserve unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations". This framework of preservation provides an ideal opportunity for mitigation partnerships in which mitigation funds are used to fund active conservation and restoration, in areas preserved by the NPS for purposes of preservation of natural scenery and historical objects. The Kahuku Unit of HVNP was acquired in 2003 for the preservation of habitat for threatened, endangered, and other rare plants and animals. To this end, NPS fenced large tracts of land within this unit, and removed ungulates to reduce the immediate threat to the preservation of these rare species and their habitat. Outside funding, such as mitigation funds, will be necessary to implement restoration methods to improve the habitat for these rare species. HVNP is listed by NPS as National Park with the second highest number of ESA-listed species. Restoration actions to address all of these species in the park will require considerable funds in addition to HVNP's operating funds. This provides an opportunity for this mitigation program to contribute to conservation of multiple species, in an area with long-term preservation guarantees.

Hawaiʻi Volcanoes National Park acquired the 150,865-acre Kahuku Unit in 2003 for the preservation of habitat for threatened, endangered, and other rare plants and animals. To this end, NPS fenced large tracts of land within this unit, and removed ungulates to reduce the immediate threat to the preservation of these rare species and their habitat. The area, which is adjacent to the Kaʻu Rain Forest Preserve, provides habitat for a number of rare, threatened, and endangered species, including the Hawaiian hoary bat and nēnē. Hawaiian hoary bats were detected at the site year-round (Fraser and HaySmith 2009). Unfortunately, much of the lowland forest (< 1,372 m [4,500 feet] elevation) is badly degraded by decades of land-clearing and destruction by cattle, mouflon sheep, and pigs. Large forest tracts have been converted to alien grass pastures and are invaded by christmasberry (*Schinus tereribinthifolia*), strawberry guava (*Psidium cattleianum)*, and kāhili ginger (*Hedychium gardnerianum*). NPS staff have constructed boundary fences and removed animals (feral pigs and cattle), but additional measures such as invasive plant control and planting of native trees are needed to facilitate forest recovery and restoration of wildlife habitat. Without active restoration, much of the area will remain dominated by non-native pasture grasses. Active restoration will include invasive plant control and planting of native trees. Outside funding, such as mitigation funds, will be necessary to implement restoration methods to improve the habitat for these rare species. Habitat restoration falls outside of the NPOS mission, which is to to “preserve unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations”. Furthermore, HVNP is listed by NPS as National Park with the second highest number of ESA-listed species. Restoration actions to address all of these species in the park will require considerable funds in addition to HVNP’s operating funds. The proposed mitigation project offers the opportunity to fund active conservation and restoration in areas preserved by the NPS for purposes of preservation of natural scenery and historical objects. This work will focus in areas with the highest need and maximum impact, where seed supplies for native tree species are limited, and where competition from invasive or aggressive woody species inhibits forest recovery.

6.2.2. Research

Tawhiri also proposes to fund a 5-year research project that will take place concurrent with restoration actions to inform future restoration efforts. The research years will be spread over the duration of the life of the ITL/ITP, and research will be concluded and reported before the end of the life of the ITL/ITP. The objective of the proposed research is to quantify the effectiveness of forest restoration actions for Hawaiian hoary bats based on bat activity and invertebrate availability.

The research objective will be accomplished by measuring three variables:

1. Changes in Hawaiian hoary bat activity over time in restoration plots
2. Hawaiian hoary bat activity inside restoration plots versus activity in non-restored plots
3. Changes in insect biomass over time in restoration plots.

Hawaiian hoary bat activity will be monitored with acoustic detectors (SM2BAT, SM3BAT, or SM4BAT models, Wildlife Acoustics). Sampling sites will be deployed in the restoration and non-restoration units. Detectors in restoration and non-restoration units will be paired by habitat type. For example, for every sampling site deployed in invasive grassland habitat in the restoration unit, one will be deployed in grassland habitat in a non-restoration unit. Bat passes will be quantified at each sampling site.

Invertebrate sampling will be conducted twice annually in the restoration units using light sampling methods. Light sampling will be conducted during the same moon phase and will take place for the same amount of time for every sampling effort. Invertebrates will be funneled into a collection device. They will be sorted into bat forage and non-forage groups. The forage group will be identified to species, if possible, and quantified for species richness.

Mean weekly and monthly bat passes will be compared within the restoration unit over time and among paired restoration and non-restoration units. Samples of invertebrate species richness will be compared over time. Year one, which is before planting begins, will constitute baseline activity for comparisons over time.

Null Hypotheses:

- Bat activity will not change in restoration units over time.
- Bat activity will not differ between restored and non-restored units.
- Invertebrate richness in the restored units will remain the same over time.

If Tier 2 or 3 take levels are triggered, additional habitat restoration, commensurate with the level of additional take the triggered Tier, will be implemented. In addition, the proposed research will be extended at a cost commensurate with the appropriate Tier level of take.

Hawaiian hoary bat mitigation will be deemed successful if

- the 5-year study has been completed, resulting in acceptance or rejection of the three Null Hypotheses listed above;
- goals, objectives, and timelines associated with reduction in targeted invasive species as identified in the mitigation proposal are met;
- activities outlined in the forest restoration and management are executed;
- timelines, progress, status and results of the restoration and research efforts applicable to the appropriate tier are provided in annual reports to USFWS and DLNR; and
- monitoring indicates the establishment of target weed species has been prevented to promote natural recovery of native species. as targeted in the mitigation proposal.

6.3. Hawaiian Petrel

The NPS also has developed a complete proposal to protect populations of federally endangered seabirds, including Hawaiian petrels and band-rumped storm petrels, on Mauna Loa in Hawaiʻi Volcanoes National Park. The NPS estimates the total project cost is approximately $281,128 over a 20-year period. The proposal is in its entirety is found in Appendix B.

The NPS will use funding to complete construction and ongoing maintenance of a predator-proof fence to protect the largest subcolony of Hawaiian petrels on the Island of Hawaiʻi from predatory cats. The fence will protect 260 ha (640 acres) of nesting habitat containing approximately 45 active nests (personal communication, Rhonda Loh, NPS, June 30, 2014) and numerous additional burrow sites for future expansion of the subcolony. In addition to protecting Hawaiian petrels, exclusion of predatory cats will benefit the band-rumped storm petrels that use the same area. The park will remove any predators initially found inside the fenced area, conduct follow-up monitoring to assess colony response, and share information with the conservation community, including adjacent landowners.

The colony, although unprotected from cats, has suffered approximately 26 fatalities from cat predation over a time period of 18 years (personal communication, Rhonda Loh, NPS, June 30, 2014). Based on this number, Tawhiri will fund a portion of the of the total NPS protection project (see Appendix B) that is commensurate with the level of requested take. Based on effectiveness monitoring by NPS, the funded portion will be sufficient to 1) offset the impacts of authorized take of Hawaiian petrels and band-rumped storm petrels and 2) provide additional mitigation resulting in an overall net conservation benefit for the species. Mitigation measures are expected to contribute to increased survival rates of adults in the area and/or in increased fledgling production. Hawaiian petrel mitigation will be considered successful and complete following full funding as described above and presented in Appendix C in detail.

Should the fence be completed before issuance of the ITL/ITP, the mitigation funds will be used for additional efforts to remove cats and mongoose from the enclosed area, and fence maintenance, or other measures the NPS determines necessary to protect the colony.

6.4. Band-rumped Storm Petrel

Based on acoustic detections, the band-rumped storm petrel is considered present and nesting in the area proposed for fencing, as described for Hawaiian petrel mitigation in section 6.3. The mitigation proposed for Hawaiian storm petrel will be used to fulfill the mitigation obligation for the authorized band-rumped storm petrel take. As with the Hawaiian petrel, mitigation for this species will be considered successful and complete following full funding as described above and presented in Appendix C in detail.

6.5. Nēnē

As a result of the emergency declaration by Governor Abercrombie in 2011 to move several hundred nēnē from Kaua‘i, the conservation needs for this species have shifted. DOFAW has agreed to provide a mitigation project for this HCP. The project will will provide a net benefit for by increasing the nēnē population on Hawai‘i Island above the level of take requested. Tawhiri will provide funding to DLNR or other assigned agency or fiduciary upon issuance of the ITP/ITL for the protection of nēnē, sufficient to achieve net benefit to the species as required in HRS Chapter 195D (Appendix C). This includes funding toward staffing operations, maintenance, and/or predator control. A full project proposal with funding will be developed between Tawhiri and DOFAW with concurrence by USFWS before implementation. Mitigation for nēnē will be considered successful and complete following full funding as agreed upon with Tawhiri, DLNR, and USFWS.

Mitigation measures are intended to provide a net benefit to the species in alignment with state and federal species recovery goals; to promote the recovery of the species within portions of its historic range; and to contribute to an increase in adult or juvenile survival and/or increased productivity (average number of fledglings per pair) at the mitigation site(s).

7. HABITAT CONSERVATION PLAN IMPLEMENTATION

7.1. Habitat Conservation Plan Administration

Tawhiri will administer this HCP. The DLNR and USFWS, as well as experts and biologists from other agencies (e.g., U. S. Geological Survey), conservation organizations, consultants and academia, may be consulted as needed. HCP-related issues may also be brought before the ESRC for formal consideration when deemed appropriate by Tawhiri.

7.2. Monitoring and Reporting

Implementation of this HCP includes compliance (i.e., fatality) monitoring and effectiveness monitoring. Compliance monitoring will be implemented to ensure accordance with the terms and conditions of the ITP/ITL. Compliance monitoring will be funded by Tawhiri as a separate expense. Effectiveness monitoring will be undertaken to assess the effectiveness of the HCP's minimization and mitigation measures towards meeting the biological goals and objectives described in section 7 of this HCP. Effectiveness monitoring is funded and implemented as part of the proposed mitigation plans. All monitoring activities on-site and off-site will be coordinated by Tawhiri's natural resources manager, with the aid of trained staff as appropriate. Monitoring efforts for which Tawhiri is responsible are described in the following sections. Any changes to monitoring will only be made with the concurrence of USFWS and DLNR.

Pursuant to HRS Chapter 195D, DOFAW may conduct independent monitoring tasks during the life of the ITL to ensure compliance with the terms and conditions of the ITP/ITL. USFWS also may conduct inspections and monitoring in accordance with the ESA and its implementing regulations (currently codified at 50 CFR 13.47).

7.2.1. Compliance Monitoring

Fatality monitoring provides a scientifically defensible means of determining compliance with ITP/ITL take limits and authorizations. Tawhiri, or an assigned third party, will conduct systematic fatality monitoring to ensure adequate fatality search data are collected for the Project. In addition to nearly three years of weekly pre-ITP/ITL fatality monitoring, compliance monitoring, as set forth below will be conducted throughout the life of the ITL/ITP.

Fatality monitoring of the site will continue to be conducted weekly for every turbine, but search frequency may be changed with concurrence from USFWS and DLNR, if considered prudent based on site-specific data.

Hull and Muir (2010) found that for small turbines (65 m [213 feet] hub height and 33 m [108 feet] blade length), 99% of bat fatalities landed within 45 m (147 feet) of the turbine base, and for medium sized carcasses, 99% fall within 108 m (354 feet).

Search plots at wind farms in Hawai'i are typically 75% of turbine height. However, because of the strong prevailing winds at the Project Area that blow consistently between 70 and 90 degrees for more than 90% of the time, it was agreed, with USFWS and DLNR concurrence (meeting with USFWS and DLNR dated 2/20/2014), that the upwind portion of the search plot could be reduced to 60% turbine height, whereas the downwind portion could be lengthened to 90% turbine height. The search plot will extend 72 m (236 feet) upwind; and 107 m (351 feet) downwind (Figure 7.1). Because the turbines are placed close to one another and all individual turbine search areas overlap, a single final search area was designed. More carcasses are expected to fall in the downwind portion of the site and, with the strong prevailing winds, carcasses are expected to fall further from the base of the turbine in the downwind portions than in the upwind portions. It is expected that the downwind portion of the search plots of several turbines will be "unsearchable" due to tall cliffs (see Figure 1.2). This will reduce the overall search area, and fatality estimates will need to be adjusted as a result.

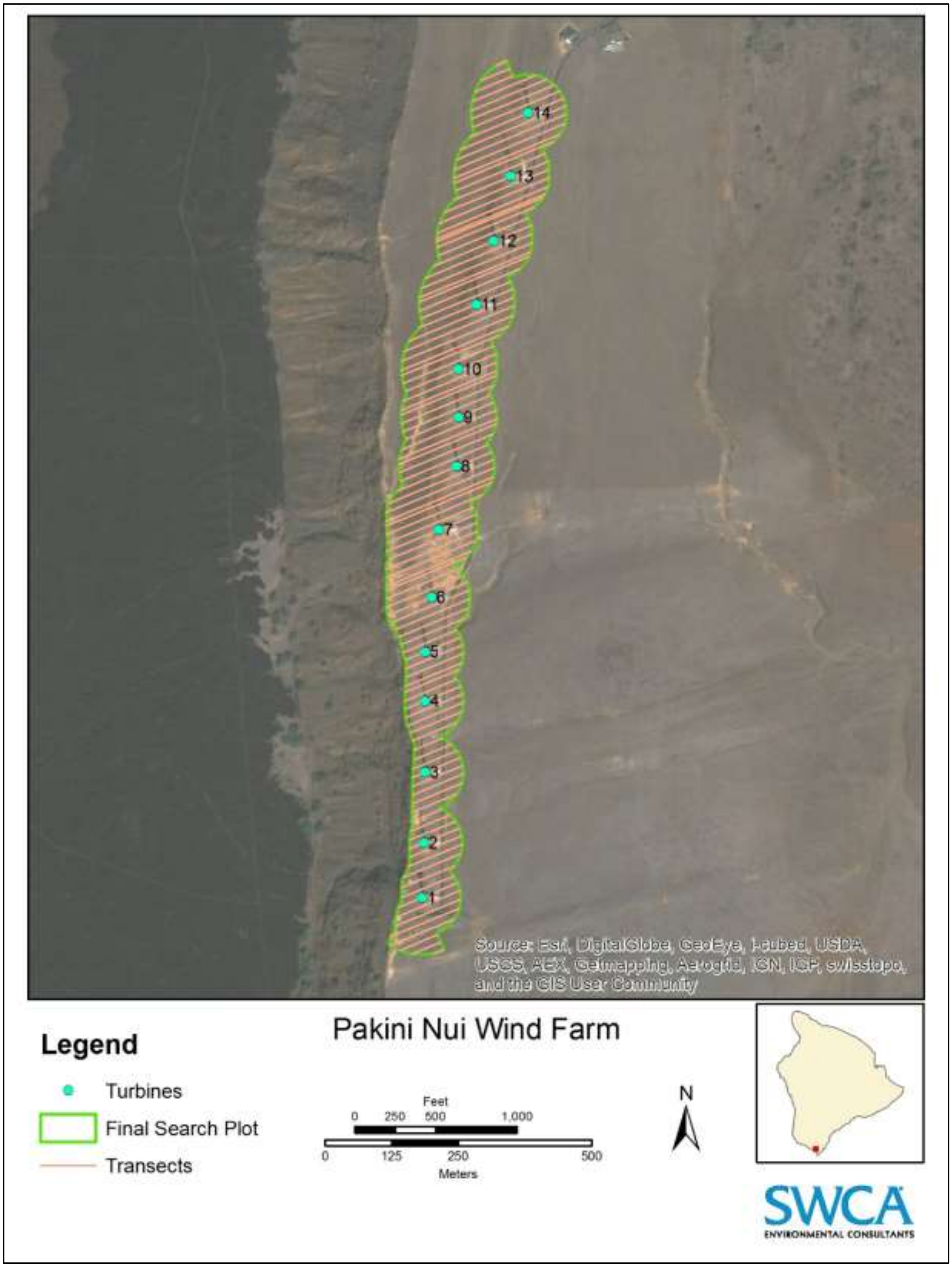

Figure 7.1. Pakini Nui Wind Farm showing search plot area, search transects, and numbered turbines.

To maximize a searcher's ability to spot carcasses, particularly those of small bats, the vegetation in the easement areas around the turbines will be maintained as short as possible by Tawhiri. Tawhiri will also coordinate with the local ranchers to maintain the vegetation as short as practical outside of the Project turbine easement area. Currently, depending on the intensity of the grazing at different locations, grass height ranges from ankle to knee high in the Project Area, making carcasses relatively easy to find. It is anticipated that continued grazing by cattle and goats will assure that additional, anthropogenic vegetation maintenance will not be necessary.

The ground cover at the site is dominated by short grass. Two types of ground cover are present; short grass/bare ground is the dominant ground cover, whereas a small area of taller grass is present in the upwind section of the site (upwind of turbines 4–6).

In all, 90 parallel transects, spaced 5 m (16.4 feet) apart across the search area will be used for compliance monitoring (see Figure 7.1). Searchers will follow the transects, searching 2.55 m (8.2 feet) on either side. Searching will be conducted by one or more searchers on foot. Current monitoring is carried out by human searchers, but the use of canine searches may be contemplated, and implemented with concurrence from USFWS and DLNR. All data collected—including information about any carcasses discovered, turbines searched, weather conditions, search dates, CARE status, and SEEF status—will be digitized into a Microsoft Excel spreadsheet format. Photographs will be taken and stored when relevant. The data will be shared with DLNR and USFWS.

CARE and SEEF trials will be carried out each year during which fatality monitoring will be conducted to determine how likely it is that a carcass landing in the search plots is detected. Measuring SEEF and CARE in the Project Area on a regular basis will be an essential part of fatality monitoring program. Carcass removal rates will help fine-tune search intervals. The SEEF trials will be proctored by a third party, and staff responsible for the fatality searches will not be aware of when SEEF trials are being conducted; this will help to avoid searcher bias.

For CARE, two size classes (small and medium) of surrogate carcasses will be used in place of endangered species that are at risk of fatality by turbine activity. Dead rats will be used as surrogates for the Hawaiian hoary bat. The approximate body size of the rats is 11.5 centimeters (cm) (4.5 inches) long. For the medium size class, dead chickens, or wedge-tailed shearwaters, if available, will be used as surrogate carcasses for medium-sized birds such as Hawaiian petrels.

A surrogate carcass will be considered taken by a scavenger if fewer than 10 of its body feathers and/or fewer than 2 wing feathers remain (Young et al. 2012).

Random locations for placement of surrogate CARE carcasses by the proctor will be generated using ESRI's Arc-GIS software. The carcasses will be placed by navigating to a random point, then tossing the carcass over the shoulder to further avoid bias in the carcass placement. The duration of carcass retention will be confirmed directly by the searcher on a daily basis, or by deploying motion-triggered game cameras. The cameras have the added benefit of aiding in documenting the cause of carcass removal.

For SEEF trials, rats will be used as surrogates for the Hawaiian hoary bat. For the medium size class, wedge-tailed shearwaters will be used when available, otherwise chickens will be used which closely match Hawaiian petrels in size. Surrogate SEEF carcass locations will also be chosen based on randomly generated global positioning system point locations within the Project search area. Proctors will place carcasses in the same manner as done for the CARE trials (see above), typically in the early morning hours and without the searcher having knowledge of where the proctors are located. The searcher must be unaware of either timing of SEEF trials or of the number of surrogate carcasses placed during these trials. When a carcass is found by the searcher, the approximate location, carcass type, and closest turbine will be recorded on the Project avian Inspection report and communicated by email and/or cell phone text message to the Project coordinator.

Efficiency will be determined as follows:

Searcher efficiency = number of surrogate carcasses found/total surrogate carcasses

After searches have been completed for the day, the searcher will notify the third-party proctor if any carcasses were discovered during the search. Proctors will verify if any undiscovered carcasses were remaining. If so, the carcasses may be left in place to determine the likelihood that the searcher will find it the following week. If a carcass has gone missing or is not recovered after the second search attempt, then that specific trial will not be counted, because it cannot be verified whether or not the carcass was actually in place during the search period.

Should a carcass of a MBTA, covered species or suspected covered species be discovered, DLNR and USFWS will be notified as soon as possible within 24 hours by phone and an incident report will be filed within 3 business days (Appendix D). A report for carcasses that are not MBTA or Covered Species will also be provided on an annual basis. Carcass and downed wildlife handling is described in Appendix D.

A table summarizing the results of incidental observations will be submitted to DLNR and USFWS twice each year. The first will be submitted in January (post-fledging for Hawaiian petrels and band-rumped storm petrels in the previous year) and the second in July (post-fledging for nēnē). In addition, in accordance with the Downed Wildlife Protocol, which was promulgated by DLNR (see Appendix D), biologists at DLNR and USFWS will be notified whenever an MBTA or Covered Species is found dead or injured.

In addition to fatality searches, Tawhiri personnel will be trained to look for and identify MBTA and Covered Species, while at the Project Area for operations and maintenance activities. This will ensure ongoing monitoring of the Project.

The likelihood of a Covered Species colliding with the tie-line is discountable, as described in sections 3.1.2, 3.2.2, 3.3.2, and 3.4.2. Ground searches have proven to be highly ineffective (Travers et al. 2014), and acoustic monitoring of the tie-line will only cover a relatively small part of the tie-line because the sound of a strike does not jump across poles. Considering the discountable likelihood of a strike, sampling is not expected to result in any detections; therefore, sampling of the tie-line is not included in the compliance monitoring for this HCP.

7.2.2. Effectiveness Monitoring

NPS or its third-party contractors will carry out effectiveness monitoring for habitat restoration for the Hawaiian hoary bat and mitigation for Hawaiian petrels and band-rumped storm petrels. NPS will monitor petrel burrows in accordance with NPS monitoring protocols to evaluate the number of active burrows and reproductive success within the fenced area. This will be compared to the baseline data collected by NPS to date to determine the success of the mitigation measures. For the Hawaiian hoary bat habitat restoration, NPS will monitor the success of invasive species control and of native plant establishment.

Unless otherwise specified, measures included in this HCP will be considered successful if they have been implemented as described in this document and as agreed upon by DLNR and USFWS. Mitigation measures go directly towards effectively achieving the Biological Goals and Objectives described in section 5 of this HCP. Implementation of mitigation measures will be reported annually to the DLNR and USFWS as described in detail below.

7.2.3. Reporting

Annual reports summarizing all activities implemented under this HCP and per the conditions of the ITP/ITL will be submitted by Tawhiri to the DLNR and USFWS. These reports will describe the results of compliance (i.e., fatality) and effectiveness monitoring, including 1) actual frequency of monitoring of individual search plots; 2) results of SEEF and CARE trials with recommended statistical analyses, if any; 3) numbers used for input into the models and copies of model outputs; 4) directly observed and adjusted levels of incidental take for each species; 5) whether there is a need to modify the mitigation for subsequent years; 6) efficacy of monitoring protocols and whether monitoring protocols need to be revised; 7) implementation and results of mitigation efforts conducted; 8) recommended changes to adaptive management and mitigation efforts, if any; 9) budget and implementation schedule for the upcoming year; and, 10) continued evidence of Tawhiri's ability to fulfill funding obligations. The annual report will be submitted by August 1 each year along with electronic copies of relevant data. The report will cover the period from July of the previous year to June of the current year. USFWS and DLNR will have 30 calendar days to respond to the report, after which a final report incorporating responses to USFWS and DLNR will be submitted by September 30. The report may also be presented to ESRC as required.

8. ADAPTIVE MANAGEMENT

Per USFWS policy (see 65 *Federal Register* 35242 [June 1, 2000]), adaptive management is defined as a formal, structured approach to dealing with uncertainty in natural resources management, using the experience of management and the results of research as an on-going feedback loop for continuous improvement. Adaptive approaches to management recognize that the answers to all management questions are not known and that the information necessary to formulate answers is often unavailable. Adaptive management also includes, by definition, a commitment to change management practices when it is determined that doing so is appropriate in maintaining compliance with the terms and conditions of an ITP and ITL.

Data resulting from compliance (i.e., fatality) and effectiveness monitoring, or significant and relevant new information recently published, may indicate the need for adaptive management. Any such changes will require the approval of the USFWS and DLNR.

After review of the annual monitoring report and in cooperation with DLNR and USFWS, or if the need for adaptive management becomes evident, Tawhiri may implement adaptive management changes approved by the DLNR and USFWS to measures described in this HCP to meet the biological objectives described in this HCP.

9. FUNDING

Consistent with ESA Section 10 and HRS Chapter 195D, a funding plan has been designed to ensure that all identified conservation actions described in this HCP will be funded in whole. Costs included in this HCP constitute a best estimate based on information available at this time.

Prior sections of this HCP describe measures that Tawhiri will undertake to minimize, mitigate, and monitor the incidental take of Covered Species. Further, this HCP describes minimization and mitigation measures intended to provide a net conservation benefit, as measured in biological terms pursuant to HRS Chapter 195D. This section summarizes planning-level cost estimates to implement the HCP, and describes funding and funding assurances. As described in the funding assurances section below, Tawhiri is responsible for covering all costs to meet mitigation obligations. All cost estimates are stated in constant 2015 dollar terms.

9.1. Habitat Mitigation Costs and Investments

HCP implementation will require investment in mitigation listed below and described in section 6 in detail:

- Hawaiian hoary bat habitat restoration (section 6.2);
- Hawaiian petrel population protection (section 6.3)
- Band-rumped storm petrel population protection (section 6.4)
- Nēnē mitigation (section 6.5)

9.2. Funding Strategies

The funding approach is based on the following:

As detailed in Appendix B, direct Project operator funding of all mitigation costs needed for the Hawaiian petrel and band-rumped storm petrel, nēnē, and Hawaiian Hoary Bat Tier 1 proposals will be provided on an annual basis upon issuance of the ITP/ITL. All other demonstrable expenses for mitigation costs for the Covered Species spanning the life of the ITP/ITL will be paid out as detailed in Appendix B. Tier 2 or Tier 3 mitigation costs for the Hawaiian hoary bat will be provided on an annual basis if more than 75% of the previous tier's take limit has been reached within the first 15 years of the ITP/ITL lifetime. Any annually protracted mitigation requiring protection from inflationary pressures will be adjusted to reflect changes in the gross domestic product implicit price deflator.

9.3. Funding Assurances

All annual mitigation and monitoring expenses including those for Hawaiian hoary bat Tier 1 mitigation will be secured by a letter of credit or other similar instrument naming the DLNR as beneficiary, which will be provided prior to issuance of the ITL/ITP. The letter of credit will be renewed on an annual basis based on the outstanding mitigation cost at the start of the following year. Additional expenses for Tier 2 and 3 Hawaiian hoary bat mitigation will be included in the letter of credit in the event that Tier 2 or 3 mitigation is triggered. The purpose of the letter of credit will be to secure the necessary funds to cover any remaining mitigation and monitoring measures in the unlikely event that there are unmet mitigation obligations due to financial insolvency.

To implement these assurances, an HCP must identify and analyze reasonably foreseeable “changed circumstances” that could affect a species or geographic area during its term (50 CFR 17.3). Should such a changed circumstance occur, the permittee is required to implement the measures specified in the HCP to respond to this change.

The “No Surprises” policy assurances only apply to species adequately covered in the HCP. Species considered to be adequately covered are those covered by the HCP that satisfy the ITL issuance criteria under Section 195D-21. The species considered adequately covered in this HCP, and therefore covered by the No Surprises policy assurances, are the Hawaiian hoary bat, Hawaiian petrel, Band-rumped storm petrel, and nēnē.

10. UNFORESEEN AND CHANGED CIRCUMSTANCES

Changed circumstances are *changes in circumstances affecting a species or geographic area covered by a conservation plan or agreement that can reasonably be anticipated by plan or agreement developers and the Service and that can be planned for (e.g., the listing of new species, or a fire or other natural catastrophic event in areas prone to such events)* (50 CFR 17.3).

The following lists changed circumstances and methods for adapting the HCP in response to each:

1) The USFWS delists a Covered Species.

   Should a Covered Species be delisted during the term of the ITP/ITL, it is expected that the program provided for in this HCP will have contributed in some part to the delisting of the Covered Species. Therefore, measures addressing that species will continue in accordance with the HCP, unless and until USFWS and DLNR agree that such actions may be discontinued.

2) The USFWS or DLNR lists a species occurring in the Project Area.

   Should one or more species that occur in, or transit through, the Project Area be listed pursuant to the ESA or under state law, Tawhiri will evaluate the likelihood of take as a result of the Project operation. If take of the species is likely, Tawhiri will seek coverage for the species under an amendment to this HCP, through a separate HCP, or by Section 7 consultation as appropriate.

3) Empirical data indicate that covered activities do not result in incidental take of a Covered Species, or result in a different level of incidental take than that anticipated in the HCP.

   Should monitoring results or data from third-party studies indicate a Covered Species is not being incidentally taken, or is being taken at levels different than that anticipated by this HCP, Tawhiri will consult with DLNR and USFWS to determine if changes to the HCP are warranted and if necessary, seek an amendment to the ITP and ITL.

4) New deterrent technology or other take avoidance or minimization methods become available to address take of Covered Species.

   Tawhiri may evaluate the value and practicality of using new deterrent technology should it become available. Should Tawhiri seek to employ new technology, and should the use of such be demonstrated to minimize or avoid take of a Covered Species, Tawhiri may consult with the USFWS and DLNR to amend the ITP and ITL if desired. The evaluation and use of new deterrent technology will be at the discretion of Tawhiri.

5) Disease Outbreaks occur in Covered Species

   Infectious disease and other inflamitory conditions may be important limiting factors contributing to nēnē mortality (USFWS 2004 and Work et al. 2015) Work et al. examined 300 nēnē from 1992 to 2013 and found that 31 infectous/inflammatory diseases resulted in the mortlity of 69 geese. These geese also have been documented to have been infected with toxoplasmosis (*Toxoplasma gondii*), omphalitis, typhlitis, avian pox (*Poxvirus avium*), avian malaria (*Plasmodium relictum capistranoae*), and avian botulism, which have contributed to mortality(Work et al. 2015). It is considered possible that the introduction of West Nile virus may affect the survival of nēnē (USFWS 2004).

West Nile virus and avian flu may pose a risk to the Hawaiian petrel if these diseases reach Hawai`i (USFWS 2005b). Warner (1968) found that at least one of a number of Hawaiian petrels reported grounded had a case of avian malaria. This may be one reason this species is now known to nest only locally on the higher volcanic slopes of Maui, Hawai`i, and Kaua`i (Warner 1968).

No studies have been conducted on the impact of disease in band-rumped storm-petrels, and the significance of disease as a factor limiting the population is presently unknown (USFWS 2004). However, avian diseases, particularly avian malaria and avian pox, both of which are transmitted by the southern house mosquito (*Culex quinquefasciatus*), have had a devastating effect on endemic Hawaiian forest birds, many of which have little resistance to introduced diseases (van Riper et al. 1986; Atkinson et al. 1995). Avian pox causes lesions on the feet, legs, and bills, and is transmitted by physical contact with an infected bird or through bites by mosquitoes carrying the disease.

A literature search indicated that disease has not been detected in the Hawaiian hoary bat.

Should prevalence of disease increase substantially and become identified by DLNR and USFWS as a major threat to the survival of a Covered Species, Tawhiri will consult with USFWS and DLNR to determine if changes in monitoring, reporting, or mitigation are warranted. Any such changes will be approved by DLNR and USFWS and will be performed to achieve mitigation objectives described in the HCP. Changes to the mitigation budget will be made with the approval of Tawhiri, USFWS, and DLNR.

6) Deleterious changes occur in relative abundance of non-native plant species, ungulates, parasites, or predators occurring at mitigation sites.

   Should the proportion or coverage of non-native plant species, parasites, or predators increase at a mitigation site and result in substantial habitat loss or degradation, or in a decline of Covered Species population at the site, Tawhiri will consult with DLNR and USFWS to determine if measures to prevent the further spread of non-native plants, parasites, or predators are available, practical, and necessary. If no new options are available or practical, remaining mitigation for the Covered Species may be implemented at another site with approval of DLNR and USFWS.

7) Natural/anthropogenic disasters (e.g., hurricanes, severe storms, and fires) substantially alter the status of a Covered Species.

   Natural and anthropogenic disasters, including hurricanes, severe storms, and fires, have potential to alter the status of 1 or more of the Covered Species on Hawai‘i and, consequently, alter the relative importance of the incidental take of individuals. Such disasters could result in loss of habitat, or decreased suitability of available habitat, and could hinder or disrupt mitigation efforts.

   If such changes occur as a result of natural or anthropogenic disasters, Tawhiri will coordinate with USFWS and DLNR to determine if any changes to operation of the HCP and mitigation areas are warranted.

8) Global climate change substantially alters status of the Covered Species.

   Global climate change within the life of the ITP /ITL (20 years) conceptually has the potential to affect Covered Species through region-wide changes in weather patterns, sea level, average temperature, and levels of precipitation affecting the species or their habitats (Intergovernmental Panel on Climate Change 2007). Covered Species may be affected through changes in temperature, precipitation, the distribution of their food resources, or possible changes in the vegetation at their preferred habitats.

As an expected result of global climate change, hurricanes or storms may occur with greater intensity (Webster et al. 2005; U.S. Climate Change Science Program 2009), which may increase the risk of damage to established mitigation sites. Sea level is predicted to rise approximately 1 m (3 feet) in Hawai‘i by the end of the twenty-first century (Fletcher 2009). Given this prediction, any rise in sea level experienced during the life of the Project likely will be less than 1 m (3 feet).

Because of climate change, precipitation may decline by 5%–10 % in the wet season and increase by 5% in the dry season (Giambelluca et al. 2009). This may result in altered hydrology at mitigation sites. Vegetation may change with decreased precipitation or increased temperatures and threat of fire. Other mitigation sites may be considered for continued mitigation if selected sites are considered no longer suitable. The alternate mitigation site or sites will be chosen in consultation with USFWS and DLNR.

Overall, if changes substantially affecting one or more Covered Species occur as a result of global climate change, Tawhiri will consult with DLNR and USFWS.

If changed circumstances occur that are not provided for in this section, and the HCP is otherwise being properly implemented, the USFWS and DLNR will not require any conservation and mitigation measures in addition to those provided for in the HCP without the consent of Tawhiri.

10.1. Unforeseen Circumstances and No Surprises Policy

Unforeseen circumstances are changes in circumstances affecting a Covered Species or geographic area covered by a conservation plan or agreement that could not reasonably have been anticipated by the plan or agreement developers and the Service at the time of the conservation plan's or agreement's negotiation and development, and that result in a substantial and adverse change in the status of the covered species (50 CFR 17.2).[1] Under the No Surprises policy, with a properly implemented HCP, Tawhiri will not be required to commit additional land, water, money, or financial compensation, or be subject to additional restrictions on land, water, or other natural resources to respond to such unforeseen circumstances beyond what has been agreed upon in this HCP unless it is with the consent of Tawhiri. For the purposes of this HCP, changes in circumstances not provided for in section 10 that substantially alter the status of the covered species are considered unforeseen circumstances.

In negotiating unforeseen circumstances, the USFWS will not require the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed on for the species covered by the HCP without the consent of the Applicant [50 CFR 17.22(b)(5)(iii) and 50 CFR 17.32(b)(5)(iii)]. The USFWS and DLNR will have the burden of demonstrating based on best available scientific and commercial data that unforeseen circumstances have occurred. The USFWS and DLNR will notify Tawhiri in writing should the USFWS or DLNR believe that an unforeseen circumstance has arisen.

[1] This HCP incorporates by reference the ITP assurances set forth in the Habitat Conservation Plan Assurances (“No Surprises”) Rule adopted by the USFWS, published in the *Federal Register* on February 23, 1998 and codified at 50 CFR 17.22 (b)(5).

10.2. Amendment Procedures

Different procedures allow for the amendment to the HCP and ITP/ITL. However, the cumulative effect of any amendments must not jeopardize the continued existence of any listed species. USFWS and DLNR must be consulted on all proposed amendments. Amendment procedures are described below.

10.2.1. Minor Amendments

Informal, minor amendments are permissible without a formal amendment process provided that the change or changes necessitating such amendment or amendments do not cause an adverse effect on any of the Covered Species that is significantly different from the effects considered in the original HCP. Such informal amendments could include routine administrative revisions or changes to surveying or monitoring protocols that do not decrease the level of mitigation or increase take. A request for a minor amendment to the HCP and ITP/ITL may be made with written notice to USFWS and DLNR. A public review process may be required for the minor amendment. The amendment will be implemented upon receiving concurrence from USFWS and DLNR.

10.2.2. Formal Amendments

Formal amendments are required when Tawhiri wishes to significantly modify the Project already in place. Formal amendments are required if the change or changes necessitating such amendment or amendments could produce a net adverse effect on any of the Covered Species that is substantially different from adverse effects considered in the original HCP and ITP/ITL. For example, a formal amendment will be required if the documented level of take exceeds that covered by the ITP/ITL. A formal amendment may also be necessary if take of another ESA-listed species not covered by the ITP/ITL becomes likely and such take is not addressed in a separate HCP or Section 7 consultation.

The HCP and ITP/ITL may be formally amended upon written notification to USFWS and DLNR with the supporting information similar to that provided with the original ITP/ITL application. The need for a formal amendment will be determined at least 1 year before the ITP/ITL expires to allow for development of the amendment application and subsequent processing before the original ITP/ITL expires. A formal amendment may require additional or modified minimization and/or mitigation measures, and/or additional or modified monitoring protocols, and appropriate funding assurances. Formal amendments undergo the same review process as an original HCP, and may require a supplemental NEPA evaluation and additional public review.

10.3. Renewal and Extension

This HCP proposed by Tawhiri may be renewed or extended, and amended if necessary, beyond its initial 20-year term with the approval of USFWS and DLNR. A written request will be submitted to USFWS and DLNR that will certify that the original information provided is still current and conditions unchanged or alternatively will provide a description of relevant changes to the implementation of the HCP that will take place. Such a request shall be made at least 180 days before the conclusion of the term of the ITP/ITL. Under federal law, the HCP shall remain valid and in effect while the renewal or extension is being processed, but under State of Hawaiʻi law, the HCP will remain valid and in effect during processing only if the renewal or extension is processed during the original ITP/ITL term.

10.4. Other Measures

An Implementing Agreement stipulating the HCP's terms and conditions in contractual form will be signed by all parties (Tawhiri, USFWS, and DLNR), if required by USFWS.

11. ALTERNATIVES

ESA Section 10(a)(2)(A)(iii) requires that an applicant consider and include in the HCP a description of alternative actions to the proposed take authorization that were considered but not adopted. Additionally, an applicant must describe why those alternatives are not being used. Alternatives focused on development and pre-construction phases of a wind farm (e.g., timing of construction, micro-siting of turbines and other infrastructure) are not applicable for consideration as alternatives at an already-operational facility. Therefore, two alternative actions to the proposed take authorization were identified, considered, and rejected by the applicant. Section 4 provide a detailed description of the chosen take authorization.

11.1. Alternative 1. Decreased Curtailment

As described in section 1.2, project turbines can and do operate on an as-available schedule, meaning that when winds are above approximately 3.5 m (11 feet) per second, turbines begin spinning. The project implemented an interim curtailment program starting in March 2014 as a precaution to minimize the risk of take of a Hawaiian hoary bat until an HCP and ITP/ITL could be put in place. The project currently curtails turbines between the hours of 6:00/6:30 p.m. (approximately 1 hour before civil sunset) and 6:30/7:00 a.m. (approximately 1 hour after civil sunrise). The turbines will shut down if the 10-minute average wind speed is 5.0 m (16 feet) per second or less (cut-out wind speed) and will start back up if the 10-minute average wind speed is greater than or equal to 5.5 m (18 feet) per second (cut-in wind speed).

Under Alternative 1, turbines will operate at an individually automated cut-in speed of 4.5 m (14.7 feet) per second and this curtailment will occur during a shortened period (e.g., between 7:00/7:30 p.m. [near the time of civil sunset] and 5:30/6:00 a.m. [near the time of civil sunrise, or seasonally]). The reduced cut-in speed and shortened curtailment window will likely result in an increase in the amount of time during which the turbine blades will be rotational.

A measure commonly implemented at wind facilities with the intent of minimizing the risk of bat fatalities is to increase the turbine cut-in speed to 5.0 m (16 feet) per second. As indicated by the data, it is widely-held among experts that bat fatalities most commonly occur during lower wind speeds. Thus, applying brakes to the turbines or allowing them to freewheel at less than 5.0 m (16 feet) per second may reduce the risk of fatality to bats. Therefore, while a reduced cut-in speed and shortened curtailment period will likely result in increased energy production at the Project, these variables may also present a greater risk of bat mortality. For this reason, Tawhiri did not adopt this alternative.

11.2. Alternative 2. Increased Curtailment

Under this alternative, turbines will be shut down daily between the hours of 6:00/6:30 p.m. (approximately 1 hour before civil sunset) and 06:30/07:00 a.m. (approximately 1 hour after civil sunrise). This measure may result in less risk of bat fatalities during the night-time period. However, the Project will experience annual production losses exceeding 50%. This type of production loss will rapidly push the Project into a financially stranded situation. Therefore, Tawhiri did not adopt this alternative.

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Appendix A.	A Proposal to Restore 600 acres of Lowland Mesic-Wet ‘Ōhi’a Forest to Benefit Hawaiian Hoary Bat and other Threatened and Endangered Species in Kahuku Unit, Hawaii Volcanoes National Park
Appendix B.	Mitigation Costs and Funding
Appendix C.	National Park Service: Assist Recovery of Endangered Seabird populations on Mauna Loa in Hawaii Volcanoes National Park
Appendix D.	Incidental Report Form and Downed Wildlife Protocol

Appendix A

This appendix contains a proposal from the National Park Service for restoration of 400 acres of bat habitat at the Kahuku section of Hawaii Volcanoes National Park. Tawhiri Power LLC will fund a portion of this proposal, commensurate with the mitigation requirement for the requested incidental take authorizations.

A Proposal to Restore 600 acres of Lowland Mesic-Wet ‘Ōhi’a Forest to Benefit Hawaiian Hoary Bat and other Threatened and Endangered Species in Kahuku Unit, Hawaii Volcanoes National Park 20 years

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Proposed Work

The park will restore 600 acres of degraded forest/pasture in Kahuku. Currently, staff are constructing boundary fences and removing animals, but additional measures, such as invasive plant control and planting of native trees, are needed to facilitate forest recovery and restoration of wildlife habitat. Restoration work is focused in areas where a limited seed supply of native tree species, and competition from alien pasture grasses and aggressive woody species inhibits forest recovery. Work crews will sweep and control target weeds, such as kahili ginger (*Hedychium gardnerianum*), christmasberry (*Schinus terebinthifolia*), and strawberry guava (*Psidium cattleianum*), propagate and plant 64,000 seedlings of native trees, and distribute two million seeds in two sites totaling 600 acres of degraded ‘ōhi’a forest/pasture (Figure 1). The work will benefit the Hawaiian Hoary Bat and at least seven additional listed endangered species, three species of concern, and 17 rare species. The total cost of the project is $1,537,470 across twenty years.

Background

In 2003, Hawaii Volcanoes National Park (HAVO) acquired the 150,865 acres Kahuku Unit. The area provides habitat for a number of rare, threatened and endangered plant and animal species (Benitez et al. 2005, Tweed et al. 2007, Pratt et al. 2011, McDaniel pers. comm.), including the endangered Hawaiian Hoary Bats which have been detected in a variety of forest habitats ranging from 2,000 ft. to 7,400 ft. elevation in Kahuku (Fraser and Haysmith 2009).

Unfortunately, much of the lowland forest (<4,500 ft elevation) is badly degraded by decades of land clearing and impacts by cattle, mouflon and pigs. Large forest tracts have been converted to alien grass pastures with portions invaded by christmasberry and incipient populations of strawberry guava and kahili ginger. The park is constructing boundary fences and removing animals, but additional measures, such as invasive plant control and planting of native trees, are needed to facilitate forest recovery and restoration of wildlife habitat. Without active restoration much of the area will remain dominated by nonnative pasture grasses without native forest regeneration.

We propose to actively facilitate forest recovery in a 600 acre block of degraded ‘ōhi’a forest/pasture (Figure 1).

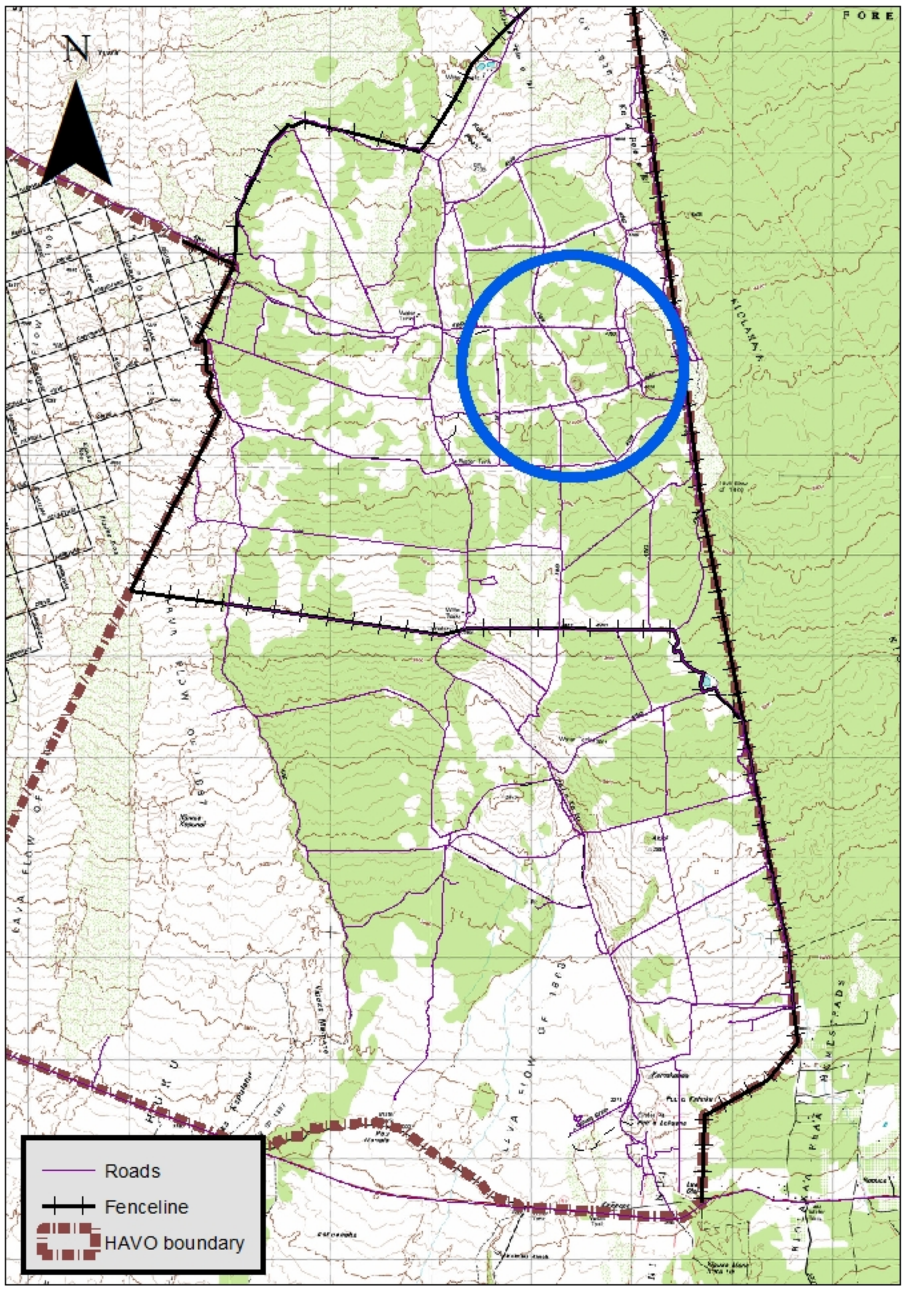

Figure 1. Map lower of Kahuku. Proposed restoration activities would be conducted within a 600 acre area (blue circle).

The proposed restoration work would benefit the Hawaiian Hoary Bat along with 7 additional listed endangered species, 3 SOC (including `i`iwi (*Vestiaria coccinea*) which is proposed for listing), and 17 locally rare species in the area (Table 1). Kahuku is also part of the Ka`ū Forest Complex which is among the priority 1 watersheds by the state of Hawaii because of its high conservation value, unique ecosystems and critically endangered rare plant and wildlife populations. The local community surrounding the park is very interested and eager to learn about and participate in restoration at the park. This restoration project will engage hundreds of community members and students while providing an opportunity to learn about the unique natural resources of Kahuku.

Table 1. Federally-listed endangered, rare and uncommon species that would benefit from active restoration of lower Kahuku

Species	**Taxon**	**Status**
Branta sandvicensis	Bird	Endangered
Buteo solitarius	Bird	Endangered
Clermonita lindseyana	Plant	Endangered
Cyanea stictophylla	Plant	Endangered
Drosophila heteroneura	Insect	Endangered
Lasirus cinereus ssp *semotus*	Mammal	Endangered
Pittosporum hawaiiense	Plant	Endangered
Prichardia lanigera	Plant	Endangered
Cyrtandra menziesii	Plant	SOC
Trematolobelia wimmeri	Plant	SOC
*Vestiaria coccinea**	Bird	SOC
Antidesma platyphyllum	Plant	Rare
Charpenteria obovata	Plant	Rare
Clermontia clermontioides	Plant	Rare
Clermonita hawaiensis	Plant	Rare
Clermontia montis-loa	Plant	Rare
Cyanea pilosa	Plant	Rare
Cyrtandra platyphylla	Plant	Rare
Marattia douglasii	Plant	Rare
Melicope radiata	Plant	Rare
Phyllostegia ambigua	Plant	Rare
Phytolacca sandwicensis	Plant	Rare
Pittosporum hosmeri	Plant	Rare
Rumex giganteus	Plant	Rare
Scaevola chamissoniana	Plant	Rare
Tetraplasandra hawaiiensis	Plant	Rare

Touchardia latifolia	Plant	Rare
Urera glabra	Plant	Rare

*Currently being studied for listing

Objective

1. Prevent establishment of target weed species to promote natural recovery

2. Plant 64,000 nursery reared seedlings and broadcast two million seeds of important native species to facilitate forest recovery across 600 acres in former pasture in the Kahuku Unit.

3. Evaluate community vegetation changes within and outside of the active restoration area.

Methods

1. **Prevent establishment of target weed species.** Work crews will conduct ground searches to locate and target weed species. GPS data will be collected for areas searched and number of plants treated. Target species include blackberry, strawberry guava, kahili ginger, and christmasberry. Control methods will follow established park prescribed treatments for each species (Table 2).

2. **Plant 64,000 nursery reared seedlings and broadcast two million seeds.** Seeds of native tree and shrub species will be collected within the local area and processed for propagation. All propagation will be conducted at the HAVO native plant facility. Facilities will be kept free of pest species; individuals will be rigorously monitored and sanitized before planting to avoid contamination of target locations. Techniques for propagating and planting common native species have been developed and applied at HAVO. Prior to planting and seed broadcasting, alien grasses will be temporarily suppressed by applying a 2% solution of imazapyr and glyphosate. Planting and seeding will be strategically placed to link existing forest fragments or build biodiversity around existing solitary trees.

3. **Monitor project success**. Vegetation monitoring plots will be established both within and outside of the project area to evaluate impacts of management actions on the vegetation community composition and structure. Plots will be established in the first year of the project and read at 10 and 20 years.

Implementation Schedule

Year 1- Begin project coordination and site visits with work leaders, begin collection of plant material and propagation. Conduct invasive plant sweeps and removal.

Year 2-5 - Begin planting of nursery reared seedlings. Complete planting of 16,000 seedlings by year 5. Broadcast one million seeds.

Year 6-10- Complete planting of 16,000 (32,000 total) nursery reared seedlings by year 10. Broadcast one million seeds. Conduct invasive plant sweeps and removal at year 6. Re-read monitoring plots at year 10. Read monitoring plots at year 10.

Year 11-15 Complete planting of 16,000 (48,000) nursery reared seedlings by year 15. Conduct invasive plant sweeps and removal at year 11.

Year 16-20 Complete planting of 16,000 (64,000) nursery reared seedlings by year 20. Conduct invasive plant sweeps and removal at year 16. Re-read monitoring plots at year 20.

Table 2. Invasive species targeted for control.

Species	**Common Name**	**Control Method**
Cestrum nocturnum	Night cestrum	10% Garlon 3A Cut Stump
Hedychium gardnerianum	Kahili ginger	1.5g/l Escort
Morella faya	Faya tree	10% Garlon 3A cut stump, 50% Garlon 3A Frill
Psidium cattleianum	Strawberry guava	10% Garlon 3A Cut Stump
Rubus argutus	Blackberry	1% Garlon 3A Foliar
Schinus terebinthifolius	Christmasberry	1% Garlon 4 Diesel

Budget

This project would be carried out over a 20 year period. The park has already significantly invested in this area by constructing fences and removing most of the nonnative ungulates. Matching funds or in-kind support provided by HAVO staff includes overall project coordination (e.g. planning, compliance, logistical support, supervision of collection of plant material, and activities in the nursery and field).

The total requested funding is $1,537,470 across 20 years. Funding will support a plant propagator or biological science technician to propagate, plant and monitor vegetation changes, pest control workers to remove nonnative vegetation, D6 equipment and operator, project supplies, transportation costs, and cultural resource survey. An annual inflation rate of 2% is built into the calculations.

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	
Pest control worker	150 worker days sweep and remove target weeds from 600 acres 1x during every 5 years	$50,250	$0	$0	$0	$0	$55,480	$0	$0	$0	$0	
Part-time Plant propagator/biological science technican 50% of GS-7	seed collection, processing, propagation, site prep, planting, monitoring	$33,181	$33,845	$34,522	$35,212	$35,916	$36,635	$37,367	$38,115	$38,877	$39,654	
D6 equipment and operator	remove grasses and facilitate seedling recruitment	$0	$5,100		$5,306	$0	$5,520	$0	$5,743	$0	$5,975	
Greenhouse	construction and maintenance	$10,000	$0	$0	$0	$0	$3,000	$0	$0	$0	$0	
Supplies	Propagation supplies, planting tools, herbicide	$7,360	$7,507	$7,657	$7,810	$7,967	$8,126	$8,289	$8,454	$8,623	$8,796	
Transportation	GSA $9600/year * 20 years	$9,600	$9,792	$9,988	$10,188	$10,391	$10,599	$10,811	$11,027	$11,248	$11,473	
Compliance	cultural resource survey	$10,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Project total with 2% inflation		**$120,391**	**$56,244**	**$52,167**	**$58,516**	**$54,274**	**$119,360**	**$56,467**	**$63,340**	**$58,748**	**$65,899**	

		Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	total
Pest control worker	150 worker days sweep and remove target weeds from 600 acres 1x during every 5 years WG-5 $335/workerday	61,254	0	0	0	0	67,630	0	0	0	0	234,614
Plant propagator/biological science technican 50% of GS-7	seed collection, processing, propagation, site prep, planting, monitoring	40,447	41,256	42,082	42,923	43,782	44,657	45,550	46,461	47,391	48,338	806,211
D6 equipment and operator	equipment needed to remove grasses and facilitate seedling recruitment	0	6,217	0	6,468	0	6,729	0	7,001	0	0	54,061
Greenhouse	construction and maintenance	3,500	0	0	0	0	4,000	0	0	0	0	20,500
Supplies	Propagation supplies, planting tools, herbicide	8,972	9,151	9,334	9,521	9,711	9,906	10,104	10,306	10,512	10,722	178,829
Transportation	GSA $9600/year * 20 years	11,702	11,936	12,175	12,419	12,667	12,920	13,179	13,442	13,711	13,985	233,255
Compliance	cultural resource survey	0	0	0	0	0	0	0	0	0	0	10,000
Project total with 2% inflation		**125,876**	**68,561**	**63,591**	**71,331**	**66,160**	**145,842**	**68,833**	**77,211**	**71,614**	**73,046**	**1,537,470**

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Appendix B: Pakini Nui HCP Funding Matrix

Category	Tier	Item	20 yr. Total	Timing of Expense	Annual Expense	Number of years
Compliance		Compliance monitoring intense monitoring	$ 2,040,000	Annually	$102,000	20
Hawaiian Hoary Bat	Tier 1	Onsite acoustic monitoring	$ 40,000	Year 1	$ 40,000	1
		Habitat Restoration at HAVO Kahuku Unit	$ 1,462,500	Annually year 1-20	$ 73,125	20
		Mitigation research	$ 487,500	Annually year 1, 2, 5, 10, 15, 20	$ 97,500	5
	Tier 2	Additional Habitat Restoration at HAVO Kahuku Unit	$ 275,000	Annual after Tier 2 is triggered	$ 18,333	15
		Mitigation research	$ 825,000	Annual after Tier 2 is triggered, for 5 years	$ 165,000	5
	Tier 3	Additional Habitat Restoration at HAVO Kahuku Unit	$ 275,000	Annual after Tier 3 is triggered.	$ 27,500	10
		Mitigation research	$ 825,000	Annual after Tier 3 is triggered, for 5 years	$ 165,000	5
Hawaiian Petrel and Band-rumped Storm Petrel		Colony protection at HAVO	$ 112,000	Annually year 1-10	$ 11,200	10
Nene		To be determined by USFWS and DOFAW	$ 30,000	Annually year 1-5	$ 6,000	5
Subtotal		Including Tier 1	$ 4,172,000			
Subtotal		Including Tier 1, 2	$ 5,272,000			
Subtotal		Including Tier 1,2,3	$ 6,372,000			

Appendix C

This appendix contains a proposal from the National Park Service to protect a colony of Hawaiian petrels at Hawaii Volcanoes National Park. Tawhiri Power LLC will fund a portion of this proposal, commensurate with the mitigation requirement for the requested incidental take authorizations.

Assist Recovery of Endangered Seabird populations on Mauna Loa in Hawaii Volcanoes National Park

Proposed Work

The park will remove cats and mongooses, monitor Hawaiian petrels and maintain bird deterrents within a newly completed predator exclosure protecting the largest subcolony of endangered Hawaiian petrels (*Pterodroma sandwichensis*) on Hawai'i Island. The exclosure fence is 5.5 miles long, surrounds over 600 acres, and uses a modified Australian design to exclude these invasive predators. Resources requested here will fund post-construction management actions including: Surveillance and initial removal of cats and mongooses from within the exclosure, subsequent monitoring and predator removal in the event of ingress (due to fence damage, etc.) and annual fence inspection ($263,590), surveys and nest density monitoring to assess bird response to predator removal ($38,668), and replacement of anti-bird strike devices on the fence across a 20 year period ($75,108). Total cost across 20 years is $392.997.

Background

The Hawaiian Petrel, or 'Ua'u (*Pterodroma sandwichensis*), was once one of the most numerous seabirds in the main Hawaiian Islands. Due to sheer numbers, this and other seabird species likely were ecologically significant as a source of marine nutrients for generally impoverished tropical soils (Loope 1998). Hawaiian Petrels also had an important place in native culture: Hawaiians harvested chicks and adults as a food source. These endangered birds still persist in remnant colonies at the margins of their former range—generally at high elevations or on steep slopes where nesting birds are best able to evade introduced mammalian predators. Here, they nest in underground burrows, coming and going after dark. The female lays a single egg in early June. Both parents take turns incubating for approximately 55 days and then feed the chick until it fledges in late November (Judge 2011).

The only known nesting colonies of Hawaiian petrels on Hawai'i Island are within Hawai'i Volcanoes National Park. Feral cat predation on nesting petrels has been documented since nests were first located on Mauna Loa in the 1990s (Hu et al 2001). In the largest of the park's colonies (typically < 50 active nests annually), 72% of the total bird carcasses located over an 18 year period were attributed to feral cat predation. Recently, mongooses have been detected at higher elevations than previously noted in the park, including in Hawaiian petrel habitat at over 8,000 feet. While a threat to the species on other islands, mongooses had not been detected in the HAVO colonies previously and represent a new threat. In addition to protecting Hawaiian petrels, exclusion of cats and mongooses will benefit two other species known to use the same area: the Band-rumped storm-petrel (*Oceandromo castro*), a species recently proposed for federal listing, and subalpine 'Oma'o (*Myadestes obscurus*).

Predation by feral cats is the primary threat to these ground nesting seabirds in the park. Although the park has trapped predators in petrel areas for over 15 years as funding permitted, the area is vast and remote, and traps cannot fully protect these colonies. Capture rates are low, and inevitably new cats move into the area and depredate additional birds. Predation by a single cat can significantly impact this small population, making it highly vulnerable to repeated cat ingress over time.

Feral cat preying on a Hawaiian petrel chick; captured via remote camera.

To address the primary threat, the park adapted a fence design that was developed, tested, and successfully used in Australia (Moseby and Read 2006), initially erecting it for protection of endangered Nēnē. Later, the park evaluated and modified this design for high elevation sites. Small-scale tests of the design successfully foiled mongooses (Misajon et al. 2009). Complimentary research conducted in the park resulted in recommendations to incorporate materials that make fences more visible to flying petrels and thus reduce the risk of fence strike (Swift 2004). After years of planning, the fence was constructed between 2013 and 2016 at a cost of $1M, including in-kind support and contributions from multiple funders in addition to the NPS. The 5.5 mile long fence incorporates newer anti-strike products developed since the early testing and encloses over 600 acres of the best nesting habitat within the park.

Aerial view of the lowest section of the fenced area.

Objectives

Remove predators (cats and mongooses) from within a recently constructed exclosure (over 600 acres) surrounding a remote Hawaiian Petrel nesting colony. Conduct annual fence inspections to ensure fence integrity; conduct surveillance to detect and respond to any incidents of ingress. Ensure bird deterrent markings on fence are adequate and replaced as needed. Monitor the bird response to predator removal at intervals by assessing changes in nest density over time.

Methods

1-Set game cameras (standard and texting) throughout the recently completed exclosure to monitor for cats and mongooses remaining inside.

2- Set various traps to capture cats and mongooses detected within exclosure. Adjust trapping strategy as needed based on information gathered from remote cameras.

3- Monitor bird response to removal of predators. Nest surveys will be conducted in the 50m x 50 m grids as outlined in the Hawaii Petrel Monitoring Protocol (Hu et al. 2015). Data collected will be used to calculate nest densities and detect trends over time.

4-At three 5 year intervals, replace deteriorated anti-strike devices (white marking tape or alternate) to ensure the fence remains visible to transiting birds.

Implementation Schedule

Year 1 and 2 - Conduct predator surveillance (via remote cameras and on the ground survey for animal sign) and control efforts to remove cats and mongooses from within the exclosure.

Years 3-20 – Conduct annual fence inspections and continue surveillance for predators via remote cameras to monitor for ingress. Conduct predator control if needed.

Years 7, 12 and 17- replace deteriorated anti-strike devices and conduct nest density survey and monitoring to measure bird response to the removal of cats and mongooses

Budget

This project will remove predators from a recently constructed Hawaiian petrel nesting exclosure, ensure the exclosure remains cat and mongoose free, monitor nest density in response to animal removal, and maintain anti-strike devices. The total requested funding is $**392,997** across 20 years.

Project	**Item**	**Cost per unit**	**# units**	**total**
Monitoring nest density at 5 yr intervals	Supplies	lump	1	$ 2,500
	Helicopter	$1000/hour	4	$ 4,000
	Personnel	$250/worker day	30	$ 7,500
	Total (annual costs based on year 1)			$ 14,000
	20 year total (year 7,12,17) with 2% annual inflation adjustment			**$ 38,668**
Replacing anti-strike devices at 5 yr intervals	Marking devices	lump	1	$ 9,820
	Helicopter	$1000/hour	4	$ 4,000
	Personnel	$250/worker day	25	$ 6,250
	total cost per tape replacement			$ 20,070
	20 year total (year 7,12,17) with 2% annual inflation adjustment			**$ 75,108**
Cat and mongoose removal, ingress monitoring/removal and fence inspections over 20 years	Traps (various)	lump	1	$ 1,800
	Trap telemetry	$350	10	$ 3,500
	Trap supplies	lump	1	$ 2,510
	Cameras (Standard and texting), supplies and data package (20 yrs)	lump	1	$ 71,832
	Field gear	lump	1	$ 3,000
	Helicopter	$1000/hour	61	$ 69,755
	Personnel	$250/worker day	400	$ 111,193
	20 year total with 2% annual inflation adjustment (year 1 = $66,120 and year 2=$38,230)			**$ 263.590**
		20 year Grand Total		**$ 392,997**

Amount requested and actions by year:

year	amount		action
1	$66,120		predator surveillance, predator removal
2	$38,230		predator surveillance, predator removal
3	$7,262		fence inspection, surveillance
4	$7,407		fence inspection, surveillance
5	$11,560		fence inspection, surveillance, camera replacement
6	$7,265		fence inspection, surveillance
7	$45,469		fence inspection, surveillance, bird monitoring, replace anti strike devices
8	$7,558		fence inspection, surveillance
9	$7,710		fence inspection, surveillance
10	$12,764		fence inspection, surveillance, camera replacement
11	$8,021		fence inspection, surveillance
12	$50,202		fence inspection, surveillance, bird monitoring, replace anti strike devices
13	$8,345		fence inspection, surveillance
14	$8,512		fence inspection, surveillance
15	$14,092		fence inspection, surveillance, camera replacement
16	$8,856		fence inspection, surveillance
17	$55,427		fence inspection, surveillance, bird monitoring, replace anti strike devices
18	$9,214		fence inspection, surveillance
19	$9,398		fence inspection, surveillance
20	$9,586		fence inspection, surveillance

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STANDARD PROTOCOL FOR State of Hawaiʻi INCIDENTAL TAKE LICENSE AND U.S. Fish and Wildlife Service INCIDENTAL TAKE PERMIT HOLDERS RESPONDING TO DEAD OR INJURED WILDIFE INCLUDING THREATENED AND ENDANGERED SPECIES AND MBTA SPECIES

Do not move wildlife unless in imminent danger.
During business hours, call DOFAW immediately for your island.

Island	Primary Contact	After business hours/weekends
Maui	(808) 984 – 8100 (808) 268 – 5087, (808) 280 – 4114	(808) 264 – 0922 (808) 280 – 4114
Molokai	(808) 553 – 1745, (808) 870 – 7598	(808) 870 – 7598
Lanai	(808) 565 – 7916, (808) 357 – 5090	(808) 357 – 5090
East Hawaiʻi	(808) 974 – 4221, (808) 974 – 4229	(808) 640 – 3829
West Hawaiʻi	(808) 887 – 6063	(808) 339 – 0983
Oʻahu	(808) 973 – 9786, (808) 295 – 5896	(808) 295 – 5896, (808) 226 – 6050
Kauaʻi	(808) 274 – 3433 (808) 632 – 0610, (808) 635 – 5117 [Secondary: (808) 348 – 5835 for Hokuala (Kauai Lagoons) HCP and Kauai Nene HCP; (808) 212 – 5551 for Kauai Seabirds HCP and KIUC Short-term HCP]	(808) 645 – 1576, (808) 635 – 5117

Fill out information on the downed wildlife form.

OVERVIEW

The islands of Hawaiʻi contain numerous native and endemic species of wildlife that are protected by strict state and federal laws. This protocol is geared towards downed (injured or deceased) wildlife and focused on the endangered Hawaiian hoary bat and avian species protected by the Endangered Species and Migratory Bird Treaty Species Acts. The likelihood of encountering injured or dead wildlife that are protected by state and federal endangered species laws should be considered equal to encountering non-listed species. Therefore, all downed wildlife should be treated with the same safeguards and care to ensure adequate response and documentation according to the following set of guidelines.

DOWNED WILDLIFE PROTOCOL

Always be prepared for discovery of downed birds and bats. Please ensure that all staff and personnel are trained in the following protocol, and that contact information, written protocols, and supplies are ready for response.

The first response for downed birds and bats is to call the local Hawaiʻi Division of Forestry and Wildlife (DOFAW) Office. DOFAW staff is generally able to respond by sending someone to the scene to retrieve the injured or deceased wildlife. In the event that DOFAW personnel are not able to respond right away, they may instruct those reporting the incident to provide necessary response. Please follow their directions carefully.

If DOFAW staff cannot be contacted, or if the downed animal is in imminent danger, you should be prepared to handle the animal yourself, following the protocol below, and transport them to DOFAW or a permitted wildlife rehabilitator. Again, you should only handle injured wildlife if DOFAW staff cannot be contacted or if the animal is in imminent danger.

PREPARING TO RESPOND FOR DOWNED OR INJURED BIRDS AND BATS

In all cases, ensure that all field staff is trained in the response protocol for injured birds and bats. Ensure they have read and understand the protocol, and have the protocol posted (including highlighted contact information) in a prominent location. Make sure that all staff know who to contact, and where supplies for handling injured wildlife are located. Staff should be regularly briefed on protocols, especially at the beginning of each distinct season that might correspond with a heightened likelihood of encountering downed wildlife.

At a minimum, for vehicles or foot patrols where maintaining a wildlife response kit (carrier) may be impractical, keep a copy of the protocol handy and accessible along with a large clean towel, soft cloth such as a t-shirt or flannel, several flags or tent stakes, and a pair of gloves, all of which are to be specifically designated for use in injured wildlife response.

For facilities and dedicated vehicles, please prepare and maintain one or more carriers designated for handling and transporting injured wildlife. This response kit should contain a large clean towel; soft cloth such as a t-shirt or flannel; several flags or tent stakes; several pairs of gloves (plastic/latex disposable gloves and also heavy duty gloves such as leather or heavy rubber that can be sanitized); eye protection; a ventilated cardboard box, pet carrier or other non-airtight container; and a copy of the protocol. For larger facilities (managed areas such as wildlife refuges, preserves, wetlands, or conservation areas), or areas where downed birds and bats are likely, please maintain several containers of various sizes. The container must provide enough room for the animal to comfortably move around, but also be sturdy enough to hold active birds or bats.

For small birds or bats, cardboard pet carriers or 'living world' plastic carriers work well as they have many ventilation holes and handles for easy carrying. Waxed pet carriers are preferred because they are sturdier, hold up longer, and can be thoroughly cleaned between uses. Sturdy cardboard boxes with holes punched in them to allow cross ventilation are also good. For birds, holes no wider than one inch in diameter should be punched on all four sides of the box. For bats, holes must be no larger than one-half inch diameter. A minimum of eight holes per side is sufficient. The carrier should be padded inside, well-ventilated and covered (to provide a sense of security).

DOWNED WILDLIFE PROTOCOL

Plastic dog kennels are recommended for handling larger birds, such as petrels, shearwaters, owls, hawks, ducks, stilts and geese. All cages must have towels or rags placed in the bottom to help prevent slipping and protect bird feet and keels. The towel or other cushioning material should be sufficient to cover the bottom of the container effectively

Cardboard boxes that are used for transporting injured wildlife should only be used once then discarded to avoid cross-contamination and/or disease or pathogen transfer. If plastic kennels or waxed pet carriers are used, be sure that they are adequately cleaned or sterilized between uses. Never put two animals in the same container.

Always wear personal protective equipment when handling downed wildlife. Disease and contamination exposure can work in both directions (bird or bat to person, and vice versa); always use protection against direct contact. If it becomes necessary to handle a bird, always wear disposable gloves. If multiple animals are being handled ensure that a new pair of gloves is used between each bird.

IF YOU FIND A LISTED DECEASED BIRD OR BAT:

All listed (MBTA and T&E species) wildlife found deceased must be reported ASAP upon detection to DOFAW and USFWS.

1. Mark the location with a flag or tent stake. Record the time and location of the observation including the animal species and its condition, photo documentation and call DOFAW immediately. Contact information is in prioritized order; if you don't reach the first person on the list, please call the next. If possible, have someone stay with the animal while someone else calls.

Island	Primary Contact	After business hours/weekends
Maui	(808) 984 – 8100 (808) 268 – 5087, (808) 280 – 4114	(808) 264 – 0922 (808) 280 – 4114
Molokai	(808) 553 – 1745, (808) 870 – 7598	(808) 870 – 7598
Lanai	(808) 565 – 7916, (808) 357 – 5090	(808) 357 – 5090
East Hawaiʻi	(808) 974 – 4221, (808) 974 – 4229	(808) 640 – 3829
West Hawaiʻi	(808) 887 – 6063	(808) 339 – 0983
Oʻahu	(808) 973 – 9786, (808) 295 – 5896	(808) 295 – 5896, (808) 226 – 6050
Kauaʻi	(808) 274 – 3433 (808) 632 – 0610, (808) 635 – 5117 [Secondary: (808) 348 – 5835 for Hokuala (Kauai Lagoons) HCP and Kauai Nene HCP; (808) 212 – 5551 for Kauai Seabirds HCP and KIUC Short-term HCP]	(808) 645 – 1576, (808) 635 – 5117

NOTE: For remote sites with spotty coverage, ground staff may need to have a planned communication system with radios, or a cell carrier known to provide adequate coverage, that will allow communication with a designated contact able to relay information to DOFAW at the appropriate numbers listed in the above table.

DOWNED WILDLIFE PROTOCOL

2. If necessary place a cover over the wildlife carcass or pieces of carcass *in-situ* (a box or other protecting item) to prevent wind, or scavenger access from affecting its (their) position(s).

3. **Do not** move or collect the wildlife unless directed to do so by DOFAW.

4. ITL and ITP holders should notify DOFAW and the USFWS as to the estimated time of death and condition of the carcass, since fresh carcasses suitable for necropsy may be handled and transported differently than older ones.

5. Downed wildlife should remain in its original position and configuration. Usually DOFAW staff will have you leave the animal in place while they come and get the animal, but dependent on the situation they may provide other instructions. Please follow their directions carefully.

1. Fill out a Downed Wildlife Form (attached). Make written notes concerning the location including GPS points, circumstances surrounding the incident, condition of the animal, and what action you and others took. This information should be reported to the appropriate official(s), including DOFAW and USFWS HCP staff, within 3 days. For DOFAW send to the following email address: dofaw.hcp@hawaii.gov.

IF YOU FIND A LISTED INJURED BIRD OR BAT WHICH IS NOT IN IMMINENT DANGER:

1. Do not put yourself in danger. Always wear personal protective equipment and clothing, including gloves and eye protection, to protect yourself when handling injured wildlife.

2. Mark the location with a flag or tent stake. Record the time and location of the observation including the animal species and its condition, and call DOFAW immediately. Contact information is in prioritized order; if you don't reach the first person on the list, please call the next. If possible, have someone stay with the animal while someone else calls.

Island	Primary Contact	After business hours/weekends
Maui	(808) 984 – 8100 (808) 268 – 5087, (808) 280 – 4114	(808) 264 – 0922 (808) 280 – 4114
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West Hawaiʻi	(808) 887 – 6063	(808) 339 – 0983
Oʻahu	(808) 973 – 9786, (808) 295 – 5896	(808) 295 – 5896, (808) 226 – 6050
Kauaʻi	(808) 274 – 3433 (808) 632 – 0610, (808) 635 – 5117 [Secondary: (808) 348 – 5835 for Hokuala (Kauai Lagoons) HCP and Kauai Nene HCP; (808) 212 – 5551 for Kauai Seabirds HCP and KIUC Short-term HCP]	(808) 645 – 1576, (808) 635 – 5117

DOWNED WILDLIFE PROTOCOL

3. Usually DOFAW staff will have you leave the animal in place while they come and get the animal, but dependent on the situation they may provide other instructions. Please follow their directions carefully.

4. While waiting for DOFAW staff to arrive, minimize noise and movement in the area around the wildlife. Watch the animal so that its location is not lost if it moves away. If possible, keep sources of additional harassment or harm, such as pets, vehicles, and loud noises, away from the animal. Note any changes in the condition of the animal.

2. 5. Fill out a Downed Wildlife Form (attached). Make written notes concerning the location including GPS points, circumstances surrounding the incident, condition of the animal, photo documentation and what action you and others took. This information should be reported to the appropriate official(s) including DOFAW and USFWS HCP staff within 3 days. For DOFAW send to the following email address: dofaw.hcp@hawaii.gov.

Do not attempt to release the bird or bat yourself. Do not move injured wildlife unless explicitly instructed by DOFAW. DOFAW will need to document circumstances associated with the incident. The animal may also have internal injuries or be too tired or weak to survive. Never throw the bird or bat into the air as this could cause more injury or result in death. Let trained staff or veterinary personnel familiar with wildlife rehabilitation and care examine the animal and decide when, where, and how to proceed.

IF YOU FIND A LISTED INJURED BIRD OR BAT WHICH IS IN IMMINENT DANGER:

3. Do not put yourself in danger. Always wear personal protective equipment and clothing, including gloves and eye protection, to protect yourself when handling injured wildlife.

4. Attempt to contact DOFAW as soon as possible, in all circumstances.

Island	Primary Contact	After business hours/weekends
Maui	(808) 984 – 8100 (808) 268 – 5087, (808) 280 – 4114	(808) 264 – 0922 (808) 280 – 4114
Molokai	(808) 553 – 1745, (808) 870 – 7598	(808) 870 – 7598
Lanai	(808) 565 – 7916, (808) 357 – 5090	(808) 357 – 5090
East Hawaiʻi	(808) 974 – 4221, (808) 974 – 4229	(808) 640 – 3829
West Hawaiʻi	(808) 887 – 6063	(808) 339 – 0983
Oʻahu	(808) 973 – 9786, (808) 295 – 5896	(808) 295 – 5896, (808) 226 – 6050
Kauaʻi	(808) 274 – 3433 (808) 632 – 0610, (808) 635 – 5117 [Secondary: (808) 348 – 5835 for Hokuala (Kauai Lagoons) HCP and Kauai Nene HCP; (808) 212 – 5551 for Kauai Seabirds HCP and KIUC Short-term HCP]	(808) 645 – 1576, (808) 635 – 5117

If the animal is in imminent danger and you are able to protect it from further harm, mark the location where it was found with a flag or tent stake.

DOWNED WILDLIFE PROTOCOL

5. Pick up the bird or bat as safely as possible. Always bear in mind your safety first, and then the injured animal. If picking up a bird, approach and pick up the bird from behind as soon as possible, using a towel or t- shirt, or cloth by gently wrapping it around its back and wings. Gently covering the head (like a tent) and keeping voices down will help the animal remain calm and greatly reduce stress. If picking up a bat, use only a soft light-weight cloth such as a t-shirt or towel (toes can get caught in towel terry loops). Place the cloth completely over the bat and gather up the bat in both hands. You can also use a kitty litter scooper (never used in a litter box before) to gently "scoop" up the bat into a container.

6. Record the date, time, location, condition of the animal, and circumstances concerning the incident as precisely as possible. Place the bird or bat in a ventilated box (as described above) for transport. Never put two animals in the same container. Provide the animal with a calm, quiet environment, but do not keep the animal any longer than is necessary. It is critical to safely transport it to a wildlife official or veterinary professional trained to treat wildlife as soon as possible. While coordinating transport to a facility, keep the injured animal secure in the rescue container in a warm, dark, quiet place. Darkness has a calming effect on birds, and low noise levels are particularly important to help the animal remain calm. Extra care should be taken to keep wildlife away from children and pets.

5. Transportation of the animal to DOFAW per coordination with DOFAW staff may be required as soon as possible.

7. Fill out a Downed Wildlife Form (attached) and report to the appropriate official(s) including DOFAW and USFWS HCP staff within 3 days. For DOFAW send to the following email address: dofaw.hcp@hawaii.gov.

6. If you must keep the bird or bat overnight, keep it in a ventilated box with a secure lid. Please keep the animal in a quiet, dark area and do not attempt to feed, handle, or release it. Continue to try to contact DOFAW staff and veterinary care facilities.

Never put birds or bats near your face. When handing a bird or bat to someone else, make sure that the head, neck, and wings are secure and in control first to avoid serious injury to handlers and to minimize injury to the animal. Never allow an alert bird with injuries to move its head freely while being handled – many birds will target eyes and can cause serious injury if not handled properly. Communicate with the person you are working with.

Never feed an injured bird or bat. The dietary needs of most species are more delicately balanced than many people realize. Most injured animals are suffering from dehydration, and attempting to feed or water the animal may kill it, as it is probably not yet able to digest solid food or even plain water. Often, when an injured animal arrives at a veterinary or rehabilitation facility, it is given a special fluid therapy for several days before attempts to feed the animal begin.

Handle wild birds and bats only if it is absolutely necessary. The less contact you have with the animal, the more likely it will survive.

DOWNED WILDLIFE FORM
LISTED SPECIES

Please be as descriptive as possible. Complete and accurate information is important.

Observer Name:	
Date of Incident:	
Date of report:	
Species (common name):	
Age (Adult/Juv), if known:	
Sex (if known):	
Incidental or Routine Search:	
Time Observed (HST):	
Time Initially Reported (HST):	
Time Responders Arrive (HST):	
General Location:	
GPS Coordinates (specify units and datum):	
Date Last Surveyed:	
Closest structure (e.g. Turbine #):	
Distance to Base of closest structure and/or nearest WTG:	
Bearing from Base of closest structure and/or nearest WTG:	
Ground Cover Type:	
Wind Direction and Speed (mph):	
Cloud Cover (%):	
Cloud Deck (magl):	
Precipitation:	
Temperature (^{O}F):	

Condition of Specimen [include a description of the animal's general condition, as well as any visible injuries, be specific (e.g., large cut on right wing tip.)]:
Probable Cause of Injuries and Supportive Evidence [attach photos and map] Be descriptive, e.g.,'teeth marks visible on upper back,' or 'found adjacent to tire marks in mud.':
Action Taken (include names, dates, and times):

Additional Comments:

IF YOU FIND DOWNED NON-LISTED WILDLIFE:

1. Do not put yourself in danger. Always wear personal protective equipment and clothing, including gloves and eye protection, to protect yourself when handling wildlife.
2. Fill out a Downed Wildlife Form for Non-listed Species (below). Make written notes concerning the location including GPS points, circumstances surrounding the incident, condition of the animal, photo documentation (if possible) and what action you and others took. This information should be reported to the appropriate official(s) including DOFAW HCP staff.
3. If you find an animal in imminent danger, following protocols above for listed species is recommended.

DOWNED WILDLIFE FORM
NON-LISTED SPECIES

Please be as descriptive as possible. Complete and accurate information is important.

Observer Name:	
Date of Incident:	
Species (common name):	
Age (Adult/Juv), if known:	
Sex (if known):	
Incidental or Routine Search:	
Time Observed (HST):	
General Location:	
GPS Coordinates (specify units and datum):	
Closest structure (e.g. Turbine #):	
Distance to Base of closest structure and/or nearest WTG:	
Bearing from Base of closest structure and/or nearest WTG:	
Condition of specimen:	
Probable Cause of Injuries and Supportive	
Action Taken:	
Additional Comments:	