STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Forestry and Wildlife
Honolulu, HI, 96813

August 23, 2019

Chairperson and Members
Board of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

SUBJECT: REQUEST FOR APPROVAL OF AMENDMENTS TO THE INCIDENTAL TAKE LICENSE AND HABITAT CONSERVATION PLAN FOR THE AUWAHI WIND ENERGY PROJECT ON THE ISLAND OF MAUI, HAWAIʻI, TAX MAP KEY: 1-9-001:006.

Submitted for your approval are the Amendments to the Incidental Take License (ITL) and the Habitat Conservation Plan (HCP) for the Auwahi Wind Energy Project (Project), on the island of Maui, Hawaiʻi. Amending the ITL and HCP are necessary because the take of the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) has exceeded the permitted take authorized in the 2012 HCP and ITL. The amendments do not request changes for any of the other covered species in the 2012 HCP and ITL.

BACKGROUND:

Auwahi Wind operates an 8-turbine, 21-megawatt wind energy generation facility on Ulupalakua Ranch in the southern half of Auwahi Ahupaua'a on Maui, Hawai'i. Auwahi Wind was issued an Incidental Take License (ITL) designated ITL-17 in February 2012 for incidental take including the Hawaiian Hoary Bat (HHB). The bat take authorized was 19 adults and 8 juveniles over the course of the 25-year permit term and later converting juvenile bats to adults, resulting in an adjusted approved take permit for 21 bats. In June 2016, model estimates showed that the calculated bat take limit of 21 had been reached. Auwahi Wind has requested an amended HCP and amended ITL to address impacts to the bats and increase the incidental take for this species over the remainder of the 25-year permit term. Low wind speed curtailment is proposed as an impact minimization measure for the bats. Auwahi Wind proposes no changes to the approved HCP and ITL for the incidental take and mitigation of Hawaiian Petrels, Nene, or Blackburn's Sphinx Moths. As of the end of 2018, the take of HHB by the project is estimated with 80% confidence to be at or below 46. Four additional bat fatalities have been observed in calendar year 2019 as of August 8, 2019.

INCIDENTAL TAKE AND MITIGATION PROPOSED:

The project has the potential to result in additional incidental take of species listed under the Federal Endangered Species Act and State Endangered Species Statute. Incidental take is determined from direct take and indirect take because it is possible that the death of a listed adult during the breeding season could result in loss of eggs or dependent young. Auwahi Wind has requested the addition of Tiers 4, 5, and 6 to the Hawaiian Hoary Bat incidental take Tiers 1, 2, and 3 in the existing approved HCP and ITL. Table 1 summarizes the take requested for the species covered in the HCP Amendment.

Table 1. Take Levels for the Hawaiian Hoary Bat Requested by Tier
(Revisions to the take in the February 2012 HCP and ITL are shown bold with underlined text.)

Common Name	Scientific Name	Tier Level	Requested Incidental Take Authorization
Hawaiian Hoary Bat ʻŌpeʻapeʻa	*Lasiurus cinereus semotus*	Tier 1	5 adults/immatures and 2 juveniles (5 bats*)
		Tier 2	10 adults/immatures and 4 juveniles (11 bats*)
		Tier 3	19 adults/immatures and 8 juveniles (21 bats*)
		Tier 4	**81 bats**
		Tier 5	**115 bats**
		Tier 6	**140 bats**

*Juvenile take, which is not expected to occur at a wind energy site, was reinterpreted subsequent to issuance of the 2012 ITL by DLNR and US Fish and Wildlife Service.

Mitigation for the Hawaiian hoary bat incidental take for Tier 4 would consist of habitat restoration that included planting of hedgerows and two small ponds as water sources within 1,750 acres of degraded forest/pasture in the Waihou, Duck Ponds, Cornwell, and Kaumea Loko areas of Maui, entering into a conservation easement for the mitigation parcels, and bat monitoring. Mitigation for Tiers 5 and 6 is tentatively proposed as land restoration/management at the Kamehamenui Forest at Kula, Maui. The mitigation actions there are intended to complement and build upon DLNR's planned conservation actions on that parcel.

PUBLIC INVOLVEMENT

The Division released the draft HCP for public comment in the December 8, 2018, Office of Environmental Quality Control (OEQC) Environmental Notice with a deadline for comment specified as February 21, 2019. During the comment period, the Division received formal comments from members of the public. Public comments are included in Attachment C.

As authorized by the Board of Land and Natural Resources (Board), DLNR conducted a public hearing relative to the proposed Auwahi Wind energy facility on February 15, 2019 to receive public testimony on the proposed HCP. Public Hearing comments are included in Attachment C.

ENDANGERED SPECIES RECOVERY COMMITTEE (ESRC) RECOMMENDATION

On February 15, 2019 the ESRC conducted a site visit to the wind energy site location. The draft HCP was reviewed by the Endangered Species Recovery Committee at regular meetings on June 19, 2019 and, following revisions, on July 25, 2019.

At the July 25 meeting five members agreed to a motion to recommend approval of the HCP to the Board. One ESRC member voted against the motion.

HRS CHAPTER 343

Related to the activities under the HCP, and pursuant to Hawai'i Revised Statutes Chapter 343, Auwahi Wind published a Draft Supplemental Environmental impact Statement (SEIS) in The Environmental Notice of the Office of Environmental Quality on December 8, 2018. The SEIS provided supplemental impact analysis based on the increased take of the Hawaiian Hoary Bat. Public comments on the Draft SEIS were accepted during the 45-day comment period and the responses included in the Final SEIS. The Final SEIS has been submitted for BLNR acceptance along with and at the same time as this final HCP Amendment.

RECOMMENDATION:

DLNR recommends that the Board:

1. Approve the Amended Incidental Take License and the Habitat Conservation Plan for the Auwahi Wind Energy Project, on the island of Maui, Hawai'i.

   By approval of the Incidental Take License the Board makes the following determinations under Hawai'i Revised Statues §195D-21(b)(1)(A-C):

   > (A) The plan will further the purposes of this chapter by protecting, maintaining, restoring, or enhancing identified ecosystems, natural communities, or habitat types upon which endangered, threatened, proposed, or candidate species depend within the area covered by the plan;
   > (B) The plan will increase the likelihood of recovery of the endangered or threatened species that are the focus of the plan; and
   > (C) The plan meets all requirements of Chap. 195D

   By approval of the Incidental Take License the Board further determines that the Habitat Conservation Plan meets all the requirements of §195D-21(b)(2).

   By approval of the Incidental Take License the Board further determines that the Habitat Conservation Plan will not violate Hawai'i Revised Statues §195D-21(c) which reads as follows:

   > The board shall disapprove a habitat conservation plan if the board determines, based upon the best scientific and other reliable data available at the time its determination is made, that the cumulative activities, if any, contemplated to be undertaken within the areas covered by the plan are not environmentally beneficial, or that implementation of the plan:
   > (1) Is likely to jeopardize the continued existence of any endangered, threatened, proposed, or candidate species identified in the plan area;
   > (2) Is likely to cause any native species not endangered or threatened at the time of plan submission to become threatened or endangered;
   > (3) Fails to meet the criteria of subsections (a) and (b); or

(4) Fails to meet the criteria of section 195D-4(g).
The habitat conservation plan shall contain sufficient information for the board to ascertain with reasonable certainty the likely effect of the plan upon any endangered, threatened, proposed, or candidate species in the plan area and throughout its habitat range.

2. Authorize the Chairperson of the Board of Land and Natural Resources to issue the Amended Incidental Take License.

Respectfully submitted,

David G. Smith, Administrator
Division of Forestry and Wildlife

APPROVED FOR SUBMITTAL:

Suzanne D. Case, Chairperson
Board of Land and Natural Resources

Attachment A: Habitat Conservation Plan Amendment
Attachment B: Amended Incidental Take License
Attachment C: Public Testimony and Public Comments

AUWAHI WIND FARM
HABITAT CONSERVATION PLAN

Final Amendment

Prepared for

Auwahi **Wind**

Auwahi Wind Energy LLC

Prepared by

TETRA TECH

July 2019

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ACRONYMS AND ABBREVIATIONS

AIC	Akaike information criterion
asl	above sea level
Auwahi Wind	Auwahi Wind Energy LLC
BCI	Bat Conservation International
CUA	core use area
DLNR	Hawai'i Department of Land and Natural Resources
DOFAW	Division of Forestry and Wildlife
EoA	Evidence of Absence
ESA	Endangered Species Act
ESRC	Endangered Species Recovery Committee
ESRC Bat Guidance	ESRC Hawaiian Hoary Bat Guidance Document 2015
GIRAS	State of Hawaii Geographic Information Retrieval and Analysis System
GIS	geographic information system
HCP	Habitat Conservation Plan
HECO	Hawaiian Electric Company
HILT	Hawaiian Islands Land Trust
HRS	Hawai'i Revised Statute
ITL	incidental take license
ITP	incidental take permit
km	kilometer
kV	kilovolt
LOC	letter of credit
LWSC	low wind speed curtailment
m	meter(s)
m/s	meters/second
MECO	Maui Electric Company
Mitigation Area	Auwahi Wind's Hawaiian hoary bat Tier 4 Mitigation Area, located on 1,752 acres of Leeward Haleakalā, on Ranch land
MW	megawatt
NAR	Natural Area Reserve
PCMP	post-construction monitoring plan
PPA	power purchase agreement

Project	Auwahi Wind Farm
Ranch	Ulupalakua Ranch
RPM	rotation per minute
SSMIP	Site-Specific Mitigation Implementation Plan
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WTG	wind turbine generator

1.0 INTRODUCTION AND PROJECT OVERVIEW

1.1 INTRODUCTION

Auwahi Wind Energy LLC (Auwahi Wind) was issued an incidental take permit (ITP) from the U.S. Fish and Wildlife Service (USFWS), and an incidental take license (ITL) from the Hawai'i Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW), for the Auwahi Wind Farm (Project) on February 24 and February 9, 2012, respectively. The ITP/ITL and associated Habitat Conservation Plan (HCP; Auwahi Wind 2012) provide coverage for incidental take of four species listed under the federal Endangered Species Act (ESA) and State of Hawai'i endangered species statutes that have the potential to be impacted by the Project, including ʻōpeʻapeʻa or Hawaiian hoary bat (*Lasiurus cinereus semotus*), the ʻuaʻu or Hawaiian petrel (*Pterodroma sandwichensis*), nēnē or Hawaiian goose (*Branta sandvicensis*), and the Blackburn's sphinx moth (*Manduca blackburni*). The ITP and ITL each have a term of 25 years and are effective through 2037.

The Project, which began commercial operation on December 28, 2012, is located on eastern Maui, Hawai'i, on Ulupalakua Ranch (Ranch). The Project consists of eight Siemens 3-megawatt (MW) wind turbines, augmented with an 11-MW battery storage system. Ancillary facilities include an underground electrical collection system, an operations and maintenance facility, an approximately 9-mile 34.5-kilovolt (kV) above-ground generator-tie line, and an interconnection substation (Figures 1-1 and 1-2). The planned operational period of the Project is from 2012-2032, 20 years of the 25-year permit term. In 2032, Auwahi Wind may consider extending the operational life of the Project for the remaining 5 years of the permit term through a new or revised power purchase agreement (PPA).

Auwahi Wind has prepared this HCP Amendment to support a request for an increase in the amount of take of the Hawaiian hoary bat that is authorized under the ITP/ITL. The current amount of authorized take for the Hawaiian hoary bat is 21 bats, an estimate that was based on the best available information at the time the ITP/ITL was issued (see Section 2.0). However, during the first 5 years of Project operation, Hawaiian hoary bat take has been higher than anticipated, and modeled estimations of take indicate that the Project has exceeded the currently authorized take limit, even with the implementation of additional, voluntary avoidance and minimization measures.

In 2015, Auwahi Wind initiated consultation with USFWS and DOFAW with the goal of preparing and receiving approval of an HCP Amendment (see Section 2.0) before the Project approached the currently authorized take limit. While not required under the approved HCP, Auwahi Wind concurrently initiated voluntary low wind speed curtailment (LWSC) with a 5.0 meter per second (m/s) cut-in speed, year-round, at the Project in 2015 to reduce the risk to bats. In 2018, the Project further increased the cut-in speed to 6.9 m/s from August through October as an additional minimization measure. The requested total bat take authorization for this amendment is 140 bats (119 in addition to the 21 authorized in the approved HCP). The amendment separates the requested take into three cumulative tiers of take (Tiers 4, 5, and 6) of 81, 115, and 140 bats, respectively. Discussion of tiers (including the biological justification) can be found in Section 5.1. Auwahi Wind has identified additional minimization measures to be implemented as well as compensatory mitigation, as appropriate. Mitigation and associated adaptive management for these tiers is outlined in Section 6.2. Adaptive management of minimization measures associated with take can be found in Section 7.4.

The biological goals from the approved HCP are still applicable for the HCP Amendment. Biological goals are intended to be broad, guiding principles that clarify the purpose and direction of the HCP (USFWS and NMFS 2016). The goals of the approved HCP are to:

- Avoid, minimize, and mitigate the potential effects on the Covered Species associated with the construction and operation of the Project;
- Increase the knowledge and understanding of the occurrence and behavior of the Covered Species in the Project vicinity;
- Adhere to the goals of the recovery plans for each of the Covered Species; and
- Provide a net conservation benefit to each of the Covered Species.

Additionally, the biological goals of this HCP Amendment are to:

- Minimize impacts to the Hawaiian hoary bat to the maximum extent practicable in the Project area; and
- Mitigate remaining impacts to fully offset impacts and provide a net benefit to the Hawaiian hoary bat by protecting, enhancing and/or managing Hawaiian hoary bat foraging and/or roosting habitat.

Avoidance, minimization, and mitigation measures that will be used to achieve these goals and associated objectives are described in the subsequent sections of this HCP Amendment (Sections 4.1, 6.2, and 7.4).

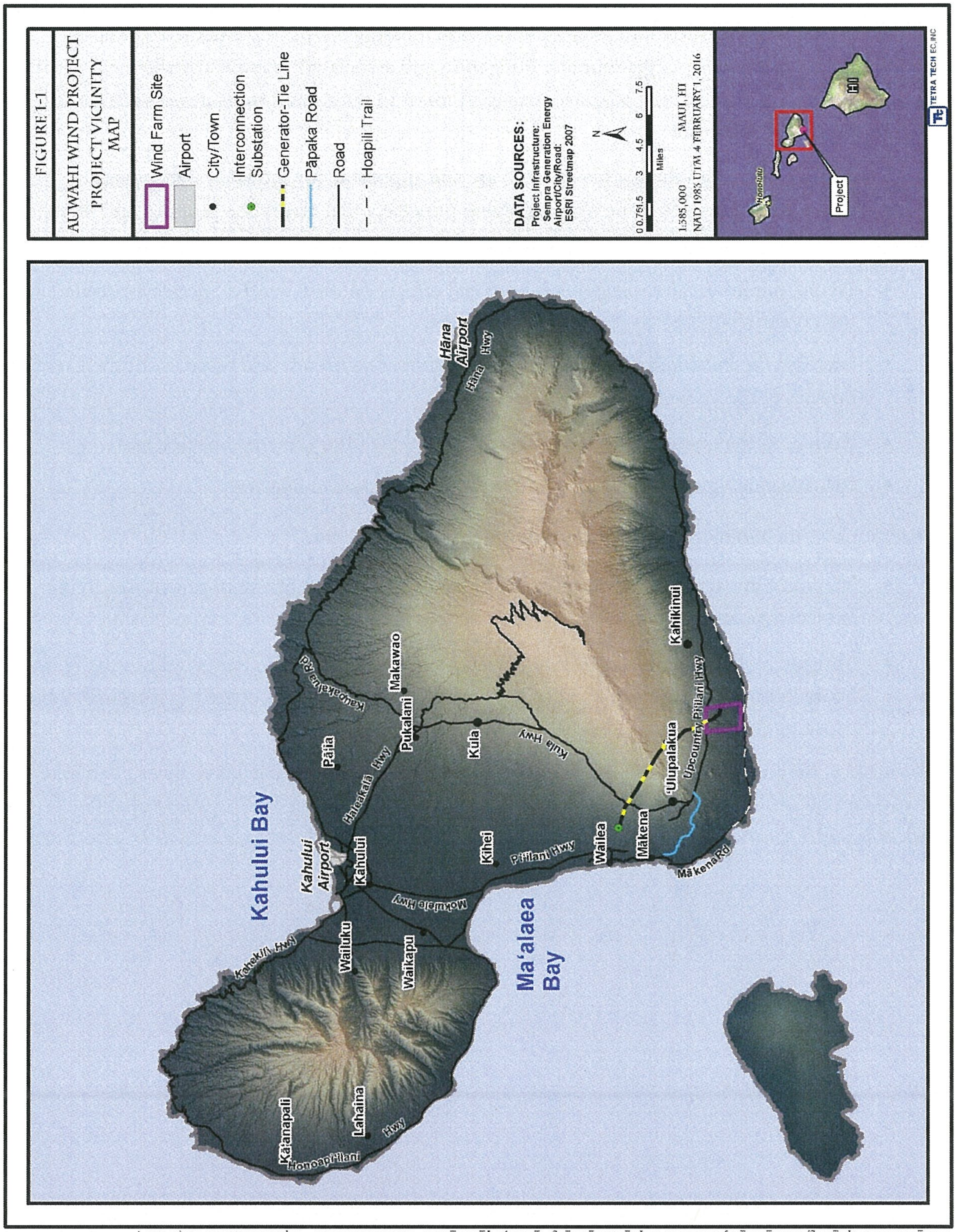

Figure 1-1. Project Vicinity Map

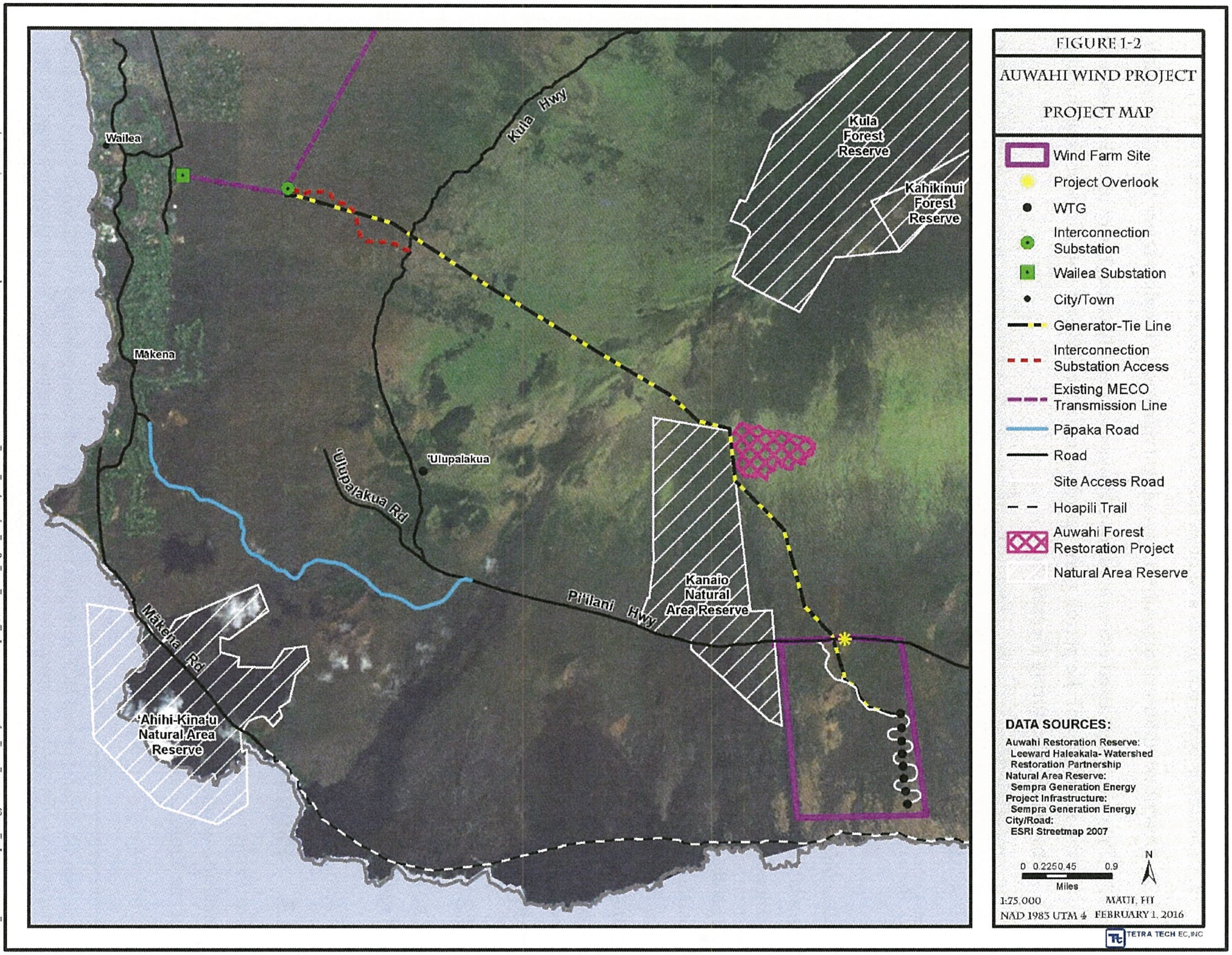

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Figure 1-2. Project Map

This Amendment:

1. Describes biological goals and objectives for the Hawaiian hoary bat (Section 4.1);
2. Describes additional measures to avoid and minimize Hawaiian hoary bat take (Section 4.2);
3. Provides an updated estimate of total Project-related Hawaiian hoary bat take, projected over the remainder of the permit term based on results of Project-specific post-construction mortality monitoring (Section 5.1);
4. Presents the request for additional authorized take of Hawaiian hoary bats (Section 5.1);
5. Identifies associated additional compensatory mitigation (Section 6.2); and
6. Presents a long-term post-construction monitoring plan (PCMP; Section 7.1 and Appendix E).

New information regarding Hawaiian hoary bat ecology, distribution, and mortality that has become available since the preparation of the approved HCP has also been incorporated to support the HCP Amendment.

This document is intended as a supplement to the approved HCP. For ease of use, this document uses the same general section organization as the approved HCP, and where appropriate, individual sections from the approved HCP are updated in this document. Sections not requiring updates for this HCP Amendment are identified by the following text after the section heading: "This section requires no edits for the HCP Amendment." The approved HCP should be referenced in these cases. The original, approved HCP can be viewed and downloaded online at: http://dlnr.hawaii.gov/wildlife/files/2013/10/Auwahi-Wind-Farm-FINAL-HCP-1-24-12-R1.pdf.

1.2 APPLICANT INFORMATION

The applicant for this HCP Amendment is Auwahi Wind Energy LLC, a joint venture between AEP Renewables, LLC (AEP) and BP Wind Energy North America Inc. The Project is operated by AEP.

1.3 PROJECT DESCRIPTION

The Project is as described in Section 1.3 of the approved HCP[1]. No physical changes to the Project facilities, or additional development is proposed under the HCP Amendment. Changes in operations of the Project associated with avoidance and minimization measures are outlined in Section 4.2.4.

[1] Section 1.1 of the approved HCP stated that the Project wind turbine generators (WTG) would have a net generating capacity of 21 MW and were expected to be curtailed at night on a regular basis based on expected Maui Electric Company (MECO) demands. Subsequently, MECO implemented a dispatch process that optimizes use of renewable energy generators, such that the Project is routinely operated at night. Each of the eight wind turbine generators is capable of generating up to 3 MW. However, even if the Project generated the full 24 MW, there is no increased risk to wildlife because the rotations per minute (RPMs) of the turbine blades are the same at 3 MW as at 2.6 MW.

The Tax Map Key (property lot identification in Hawai'i) for the HCP Amendment is (2) 1-9-001:006.

1.4 Regulatory Framework and Relationship to Other Plans, Policies, and Laws

This section requires no edits for the HCP Amendment.

2.0 DESCRIPTION OF THE HABITAT CONSERVATION PLAN

2.1 PURPOSE AND NEED FOR THE HCP

The purpose and need for the HCP Amendment is to address impacts to the Hawaiian hoary bat beyond those authorized under the existing ITP/ITL, and to request the authorization of additional incidental take for the Hawaiian hoary bat. The HCP Amendment identifies appropriate minimization measures, mitigation actions, adaptive management strategies, and monitoring requirements associated with the requested additional take. The approved HCP and the HCP Amendment both respond to the need for authorization of incidental take of listed species associated with the Project, pursuant to the ESA and Hawai'i Revised Statutes (HRS) Chapter 195D, and the need for measures to minimize and mitigate these impacts to the maximum extent practicable. The ITP/ITL application requires development of an HCP that ensures the continued existence of, and aids in the recovery of the Hawaiian hoary bat while allowing for incidental take of the species during Project operation.

Take of Hawaiian hoary bats at the Project has been higher than anticipated under the approved HCP, in part because risk to bats associated with wind energy development in Hawai'i was largely unknown and underestimated at the time the HCP was approved. Additionally, a significant amount of data has been collected that is now available to support statistical projections of future fatality rates. When the approved HCP was prepared, post-construction mortality monitoring data from Hawai'i wind farms were limited. Estimates of take were based on the best available surrogate information, such as preliminary monitoring data from one operating wind farm in Hawai'i and general comparisons of bat acoustic activity among sites, which now are shown to have underestimated collision risk for bats. Advancements in acoustic monitoring and thermography have shown that prior population estimates under-reported the abundance of the Hawaiian hoary bat (Gorresen et al. 2017). Since the development of the approved HCP, USFWS and DOFAW have adopted a more conservative standard for estimating bat take (e.g., Evidence of Absence [EoA] statistical software; see Section 5.0), which is also now used to evaluate HCP compliance. This software enables the incorporation of fatality data from previous years, or informed assumptions in the absence of such data, to model fatality rates over time, accounting for both observed and unobserved take. The model is conservative in that it does not produce a point estimate of a number of fatalities, but enables the identification of a range of fatality estimates with an upper limit defined by a user-selected confidence threshold (see Section 5.0, Appendix H).

The HCP Amendment employs the EoA statistical software and Project-specific post-construction mortality monitoring data (see Section 5.0, Appendix H), which improves the understanding of inter-annual variability in fatality rates and other Project-specific uncertainties. Thus, this HCP Amendment is anticipated to more accurately estimate the range of Hawaiian hoary bat take over the remaining years of Project operation, and better matches the current approach taken by USFWS and

DOFAW to assess ITP/ITL compliance, as compared to the approved HCP. See Appendix E for details associated with long-term post-construction mortality monitoring and compliance.

2.2 SCOPE AND TERM

The HCP Amendment does not propose any changes to the scope of the approved HCP (all areas where construction and operation of the Project and associated facilities have the potential to affect the Covered Species), or to the original permit term of 25 years (2012 – 2037).

2.3 SURVEY AND RESOURCES

The following resources were used during the preparation of the HCP Amendment:

- Data from Project operations (2012 – 2017);
- Results from post-construction mortality monitoring surveys (2013 – 2017);
- Acoustic bat monitoring surveys using Wildlife Acoustics monitors (July 2013 – December 2015);
- EoA fatality modeling software (version 2.0, Dalthorp et al. 2017); and
- The Endangered Species Recovery Committee (ESRC) Hawaiian Hoary Bat Guidance Document (ESRC Bat Guidance; DOFAW 2015) and subsequent verbal and written guidance and recommendations provided by USFWS and DOFAW.

3.0 ENVIRONMENTAL SETTING

3.1 REGIONAL LOCATION

This section requires no edits for the HCP Amendment.

3.2 LAND USE

This section requires no edits for the HCP Amendment.

3.3 TOPOGRAPHY AND GEOLOGY

This section requires no edits for the HCP Amendment.

3.4 SOILS

This section requires no edits for the HCP Amendment.

3.5 HYDROLOGY AND WATER RESOURCES

This section requires no edits for the HCP Amendment.

3.6 TERRESTRIAL FLORA

This section requires no edits for the HCP Amendment.

3.7 NON-LISTED WILDLIFE

This section requires no edits for the HCP Amendment.

3.8 LISTED WILDLIFE

This section requires no edits for the HCP Amendment except as provided in the subsections below.

3.8.1 Hawaiian Hoary Bat

3.8.1.1 Distribution, Population Estimates, and Ecology

The Hawaiian hoary bat is the only fully terrestrial, native mammal in the Hawaiian Islands. Recent studies and ongoing research have shown that bats have an extensive distribution across the islands (Bonaccorso et al. 2015, Gorresen et al. 2013, H.T. Harvey and Associates 2019, Starcevich et al. 2019) and breeding populations are known to occur on all of the main Hawaiian Islands except Ni'ihau and Kaho'olawe (Bonaccorso et al. 2015). Numerous research studies have been conducted on the Hawaiian hoary bat in the last decade. The bat has been detected broadly across the State and on Maui specifically. The most current studies of the Hawaiian hoary bat population come from occupancy modeling on Hawai'i Island from 2007 – 2011, which show the population of the Hawaiian hoary bat is "stable to increasing" (Gorresen et al. 2013). Documented occurrences of the

Hawaiian hoary bat from monitoring at wind farms, associated mitigation sites, and research show that the bat is more widespread and abundant than the estimate provided in the 1998 USFWS Hawaiian hoary bat recovery plan (Auwahi Wind 2017, Kaheawa Wind Power 2017, Kaheawa Wind Power II 2017, Gorresen et al. 2013, Bonaccorso et al. 2015, HT Harvey 2019).

The Hawaiian hoary bat has been observed in a variety of habitats, including open pastures and more heavily forested areas, and in both native and non-native habitats (DLNR 2015, Gorresen et al. 2013). In addition to utilizing undeveloped areas, foraging and roosting has been documented in a variety of developed areas (golf courses, urban, suburban, rural, military and industrial) on O'ahu, Maui, Kaua'i, and Hawai'i Island (Kawailoa Wind Power 2014, Jacobs 1994, USFWS 1998). Typically, this species feeds over streams, bays, along the coast, over lava flows, or at forest edges. Hawaiian hoary bats have also been documented using forest gaps and clearings, forest edges, along roads, and along hedgerows for foraging (Bonaccorso et al. 2015).

Gorresen et al. (2013) found that Hawaiian hoary bats concentrated in the lowlands during the breeding season on Hawai'i Island, and migrated to interior highlands during the non-breeding season. Limited data suggest breeding may primarily occur at lower elevations, at 3,300 feet (1,000 meters [m]) above sea level (asl) or lower; however, a pregnant female was captured in June 2017 above 5,000 feet asl (DOFAW 2015; Corinna Pinzari, USGS, personal communication).

Hawaiian hoary bats are found in both wet and dry areas from sea level to 13,000 feet asl, with most observations occurring below 7,500 feet. Although the Hawaiian hoary bat may occasionally disperse between islands and demonstrate seasonal movement within topographical gradients on the islands, long-distance migration like that of the mainland hoary bat is not documented (USFWS 1998). Seasonal and altitudinal differences in bat activity have been suggested (Menard 2001). Hawaiian hoary bats can range among habitats and elevations within a single night to target optimal local foraging opportunities (Gorresen et al. 2013, 2015. Bonaccorso et al. 2016).

Roosting Habitat

Hawaiian hoary bats are known to have solitary day roosts in tree foliage, and have only rarely been seen exiting lava tubes, leaving cracks in rock walls, or hanging from human-made structures. Foliage roosting has been documented in hala (*Pandanus tectorus*), coconut palms (*Cocos nucifera*), kukui (*Aleurites moluccana*), pūkiawe (*Styphelia tameiameiae*), Java plum (*Syzygium cumini*), kiawe, avocado (*Persea americana*), shower trees (*Cassie javanica*), ʻōhiʻa trees (*Meterosideros polymorpha*), fern clumps, ironwood (*Casuarina equisetifolia*), macadamia (Macadamia spp.), and mature eucalyptus (*Eucalyptus* spp.) plantations; they are also suspected to roost in Sugi pine (*Cyrptomeria japonica*) stands (USFWS 1998; DLNR 2005, Gorresen et al. 2013, Kawailoa Wind Power 2013). Hawaiian hoary bats have also been observed using night roosts to rest after foraging or seek shelter from rain (Todd 2012). Generally, bats are thought to use night roosts to serve several potential functions for bats: energy conservation, digestion, predator avoidance, information transfer, and social interactions (Kunz 1982). The selection criteria of bats in general for night roosts is not well documented, but proximity to foraging grounds is suggested to be an important criterion (Knight 2009).

Breeding

Breeding activity takes place between April and August, with pregnancy and the birth of two young (occasionally one) occurring from April to June (Bogan 1972). Based on the data available, USFWS estimates the Hawaiian hoary bat reproductive rate to be 0.54 offspring per female surviving to adulthood (USFWS 2016a). Until weaning at 3 months of age, the young are completely dependent on the female for survival. Lactating females have been documented from June to August, and post-lactating females have been documented from September to December (Menard 2001). USFWS and DOFAW have interpreted this as female Hawaiian hoary bats potentially having dependent young from April 1 – September 15 (USFWS and DOFAW 2016). The lifespan of the Hawaiian hoary bat has been estimated to be a minimum of 4 years (Bonaccorso 2016) and a maximum of 10 years (DOFAW 2015).

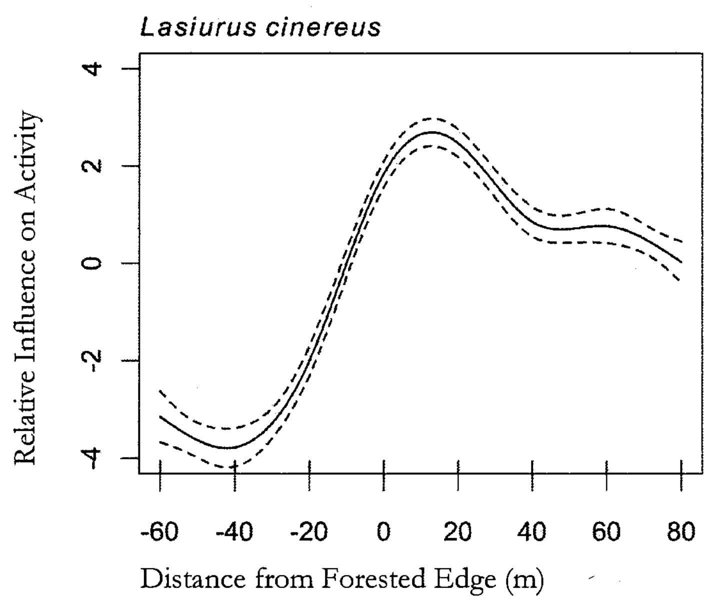
Foraging Habitat and Diet

The Hawaiian hoary bat is an insectivore, and prey items include a variety of native and non-native night-flying insects including moths, beetles, crickets, mosquitoes, and termites (Whitaker and Tomich 1983). Fecal pellet analysis and insect sampling have shown that 99 percent of the Hawaiian hoary bat diet consists of moth and beetle prey (Todd 2012). Above 2,000 feet, Hawaiian hoary bats selectively ate beetles (43 percent of diet) relative to their abundance at study sites (<4 percent of insects sampled), although species such as moths and beetles may be overestimated in fecal pellet analysis due to sampling bias. Additionally, bat activity is correlated with insect activity (Todd 2012, Gorresen et al. 2018). Bats are documented to travel up to 7 miles per night to reach foraging grounds (Bonaccorso et al. 2015).

Water provides an essential habitat component for foraging, reproductive, and basic physiological requirements for bat species. All bats, with the exception of a few frugivorous or nectivorous bats, drink water (van Helverson and Reyer 1984). Water sources have been shown to increase Hawaiian hoary bat activity relative to surrounding habitats (SWCA 2011). Mainland and Hawaiian hoary bats have been documented at artificial water sources such as reservoirs (Jackrel and Matlack 2010, Vindigni et al. 2009, Uyehara and Wiles 2009). Hawaiian hoary bats have been captured foraging for moths over open water (Todd 2012, USFWS 1998). Additionally, bat use of natural and artificial water sources as foraging substrates is well documented on the mainland and in Europe (Brooks and Ford 2005, Heim et al. 2018, Vindigni et al. 2009), specifically drinking from water troughs in arid regions of the mainland United States (Jackrel and Matlack 2010, Tuttle et al. 2006, Vindigni et al. 2009).

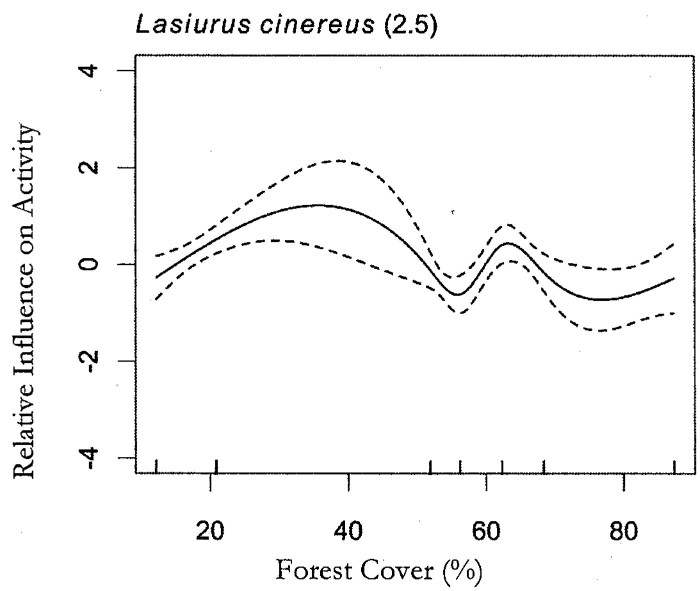
The Hawaiian hoary bat feeds primarily in edge and open habitats, which is supported by call structure, wing shape, and behavioral observations. Hawaiian hoary bats weigh about 45 percent less than mainland hoary bats, which are open area foragers (Fenton 1990), and this smaller body mass leads to lower wing loading and an increased aptitude for flying in both open and more cluttered environments (Jacobs 1996), such as edge habitats. Hawaiian hoary bats also use high-intensity echolocation calls with a mix of narrow and broadband components, which is consistent with forest edge habitat foraging behavior. Edge habitats in general provide efficient foraging habitat that minimizes commuting energy costs and maximizes foraging opportunities (Grindal and Brigham 1999). Edge habitats also provide benefits to some insect species (Langhans and Tockner 2014), as well as providing shelter where insects congregate and where bat foraging activity increases (Grindal and Brigham 1999).

Additional information on the use of edge habitat by mainland hoary bats is expected to be relevant to the Hawaiian hoary bat. Research on mainland hoary bats has evaluated the habitat density and distance from forest habitats that are correlated with higher use rates by bat species (Jantzen 2012). For mainland hoary bats, increased activity was recorded out to 262 feet from forest edges (Figure 3-1). In addition to looking at bat activity at varying distances from edge habitats, this research also included a geographic information system (GIS) analysis of the habitat at varying spatial scales to assess how the percent of forest cover influenced bat activity. At the 0.9-mile and the 1.5-mile spatial scale, a bimodal distribution with statistically significant peaks of activity were noted from 20 to 25 percent forest cover and at 70 percent forest cover. The data from the 1.5-mile spatial scale suggest increased activity up to 40 percent forest cover (Figure 3-2).



Source: Jantzen 2012, reproduced with permission

Figure 3-1. Relative Bat Activity Compared to the Distance from a Forest Edge



Source: Jantzen 2012, reproduced with permission

Figure 3-2. Hoary Bat Activity Relative to the Forest Density at the 1.5-mile Spatial Scale

A Hawaiian hoary bat's foraging range contains the area used by an individual bat foraging for food and movements to and from day roosts and night roosts. The Hawaiian hoary bat foraging range on Hawai'i Island in late spring, summer, and fall was moderately large (mean of 570.1 ± 178.7 acres [230.7 ± 72.3 hectares]), but foraging activity within this range was concentrated within small core use areas (CUA; 11.1 percent of mean foraging range; Bonaccorso et al. 2015). The term CUA is defined as areas within the foraging range that have very intensive use. Although this study reports no overlap in adult male CUA, overlap is documented in the CUA of sub-adults and the larger foraging ranges. Additionally, multiple bats have been observed to use the same resources, such as the 11 bats captured and tagged near the Pu'u Makua mitigation site (Auwahi Wind 2017). Thus, individual male Hawaiian hoary bats may have overlapping foraging ranges, but appear to have almost no overlap in CUA. This lack of overlap is supported by behavioral studies in which antagonistic interactions have been documented between individuals (Belwood and Fullard 1984). The median CUA of 20.3 acres is reported by DOFAW (DOFAW 2015) and the size of core use areas is illustrated in Figure 3-3. Variation in CUA size may depend on age, habitat suitability, and foraging efficiency (Bonaccorso et al. 2015, Pinzari 2014). Data from Bonnocorso et al. (2015) suggests that although there is variability in the size of CUAs[2], subadults tend to use larger core use areas than adults.

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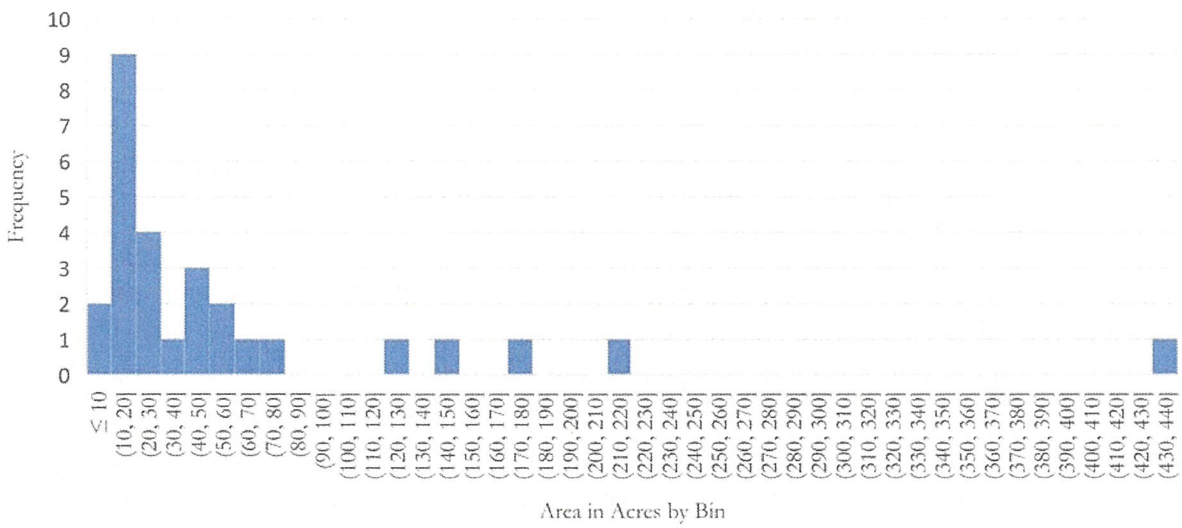
[2] In January 2019, HT Harvey presented preliminary research to the ESRC (HT Harvey 2019). The study showed bats have a broad distribution across the area surveyed. Preliminary findings from 5 bats tracked for 5 nights suggest "Bats regularly forage over a large area 2967 acres". The final report and methods for this study are not yet available.



Source: Bonaccorso et al. 2015

Figure 3-3. Histogram of Core Use Area Sizes (acres) Binned by 10 acres

Population

Literature Review

As previously identified, neither a state-wide nor an island-wide population estimate has been derived for the Hawaiian hoary bat. Current studies are working toward collecting the empirical information to be able to provide more of a statewide estimate and suggest the Hawaiian hoary bat has a relatively large population statewide and on Maui. The Hawaiian hoary bat has been detected broadly statewide and across Maui in many habitats. In most of the locations where people have made efforts to detect the Hawaiian hoary bat, they have been documented. The life history traits known for the bat suggest it is a species resilient to environmental changes. Occupancy models and genetic studies have been, and continue to be, conducted to attempt to determine population indices and effective population sizes; effective population does not necessarily equate to actual population size (Gorresen 2008, Gorresen et al. 2013). Thus, using the best available information for the bat, an estimate of an overall population range for Maui can be derived that takes into consideration land cover and occupancy in addition to use of proxy assumptions. This section describes in more detail the parameters considered for this exercise to model a population range for Maui.

The life history characteristics known for the Hawaiian hoary bat provide indicators that the population would be expected to be widespread, abundant, and resilient to change:

- The ability of the Hawaiian hoary bat to fly long distances to utilize resources;
- The utilization of a variety of tree species for roosting;
- The ability to forage in a variety of habitats;
- The utilization of a wide elevational gradient for foraging and roosting;

- The consumption of a broad array of insect species and ability to change diet species with prey availability; and,
- The high capacity for reproductive output.

Occupancy is the proportion of an area occupied by a species or fraction of landscape units where the species is present, and can be used to estimate trends (MacKenzie et al 2019). The most current studies of the Hawaiian hoary bat population come from occupancy modeling on Hawai'i Island from 2007 – 2012, which show the population of the Hawaiian hoary bat is "stable to increasing" (Gorresen et al. 2013). On Hawai'i island mean occupancy of all survey areas for all times of year was 0.63. Preliminary results from an occupancy study underway island wide on the island of O'ahu found an initial occupancy rate estimated at 0.47, results of this study are subject to change as the study progresses. The proportion of nights that bats are detected gives an indication of relative abundance across sampling sites(Frick 2013). The proportion of nights with bats detected from 2007-2011 was measured at 38 percent across all sites from Hawaii Island (Gorresen et al. 2013). In comparison, bat detections at the Project (31 percent of nights with detections, Auwahi Wind 2015), Nakula NAR (31 percent of nights with detections, Todd et al. 2016) and Pu'u Makua (38 percent of nights with detections, Auwahi Wind 2017) indicate similar bat abundance across monitored areas. Because detection rates are associated with bat abundance, there are likely similarities between the occurrence on Hawai'i Island and Maui.

Exercise in estimating Hawaiian Hoary Bat Population

Taking in to consideration the indicators and occupancy modeling parameters considered above, a population estimate exercise is described below. In the absence of a population estimate, habitat characteristics could be used as a proxy to estimate Hawaiian hoary bat populations. Maui is approximately 465,280 acres of which approximately 32.2 percent is forested (NOAA 2018). This area equates to approximately 150,000 acres of forest on Maui. Approximately 3 percent of Maui represents developed lands, or areas occupied by human structures and impervious surfaces, and an additional 3.5 percent represents barren land. This land use assessment indicates that approximately 93.5 percent of Maui consists of forest, agricultural, rangelands, and wetlands (Figure 3-4), which at varying degrees provides suitable habitat for the Hawaiian hoary bats.

This exercise will look at density and distribution to estimate a population. All studies that examine bat use in varying habitats show Hawaiian hoary bats use habitats at varying densities. To ensure that the population estimate is conservative, both the estimate of density and the distribution are conservative. The estimate provided here assumes that only 30 percent of the area of Maui, or 140,000 acres, is potentially acceptable CUA for bats. This area is roughly based on the proportion of the forested area of Maui as a proxy for bat occurrence. This proxy is based on the association with mature forest (Gorresen et al. 2013) and the need for day roosts. However, this estimate may incorporate forest lands, and portions of the agricultural, and rangelands. Of the 30 percent of habitat that could be occupied, the area estimated to be occupied by bats is 60 percent based on the observations of occupancy from published findings from Hawai'i[3] (Gorresen et al. 2013). This habitat suitability assessment serves as a proxy for the estimated extent of occurrence on Maui.

In addition to the extent of occurrence, the density of bats on Maui must also be estimated to derive a population estimate. Measurements of Core Use Area (CUA) from Hawai'i Island provide estimates of CUA in acres per bat (Bonaccorso et al. 2015):

- The median CUA is 20.3 acres (DLNR 2015); and
- The interquartile range (IQR) is from 16 acres to 58 acres.

A typical measure of statistical dispersion is the IQR. If the lower quartile CUA (16 acres) is used to represent a high-end estimate for the density of bats on Maui and the upper quartile CUA (58 acres) represents a low-end for density, the population may range between approximately 1400 to 5200 individuals.

$$Low\ Population\ Estimate = 1400\ bats \approx \frac{140{,}000\ acres * 60\%\ occupied}{58\ \frac{Acres}{Bat}}$$

$$High\ Population\ Estimate = 5200\ bats \approx \frac{140{,}000\ acres * 60\%\ occupied}{16\ \frac{Acres}{Bat}}$$

As previously identified, this population exercise provides an indication of scale and risk analysis. Despite the use of conservative estimates of the proportion of the island utilized and occupancy, the exact numbers of the population should be treated with caution as the estimates may vary if the input parameters are altered. For example, bats have been documented to have seasonal variation in use, and also documented to use non-forested areas (Auwahi Wind 2017, Todd et al. 2016). Nevertheless, this population estimate, documented bat observations, and the life history characteristics described above all suggest the Hawaiian hoary is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources.

Genetics

Recent research indicates that Hawaiian hoary bats on Maui may consist of two distinct lineages because of multiple colonization events (Baird et al. 2015, Russell et al. 2015, Baird et al. 2017). Currently only one bat species is recognized as present in Hawai'i, and it is listed as endangered; it is possible that federal and state regulatory agencies may make a revised listing determination in the future, considering new taxonomic information on the two potential lineages (DOFAW 2015). Potential impacts to the Hawaiian hoary bat are not expected to differ by lineage; therefore, the amendment should remain valid in the event of agency recognition of subpopulations.

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[3] Measurements from Hawai'i Island included primarily natural or forested habitat and found 0.63 occupancy (and the average, site-specific occupancy excluding Hilo was 0.91), suggesting the use of 0.6 is conservative.

Research

The Hawaiian hoary bat recovery plan (USFWS 1998) and the ESRC Bat Guidance (DOFAW 2015) acknowledge the benefits of additional research to further understand the ecology and life history of the Hawaiian hoary bat. The USFWS, DOFAW, and ESRC approved several research projects that are being conducted on Maui, O'ahu, and Hawai'i Island to better understand some of the key limiting factors for the Hawaiian hoary bat. These studies should provide insight into the life history, population, and habitat needs of the Hawaiian hoary bat that could inform future minimization and mitigation measures to help reduce the impacts to Hawaiian hoary bats. The research projects are anticipated to conclude between 2020 and 2022.

3.8.1.2 Threats

Overview of Primary Threats to the Species

Little is known overall about specific threats to the Hawaiian hoary bat due to a lack of data, although the data that do exist indicate that there are three major observed threats, as well as several unquantified threats that have yet to be properly evaluated. The three greatest threats causing additive mortality to Hawaiian hoary bats, based on observed fatalities and as identified in the ESRC Bat Guidance (DOFAW 2015), are wind turbines, removal of trees during the bat pupping season, and barbed wire. These threats have the potential to cause a localized reduction in bat numbers.

Wind turbines are responsible for the highest number of observed fatalities of Hawaiian hoary bats statewide, but wind facility operation is also the only activity with data from intense, long-term monitoring. The risk of collision with wind turbines can be minimized through LWSC as has been documented in several mainland studies (Arnett et.al. 2010, Arnett et al. 2013, Martin et al. 2017). LWSC is defined as restricting operation of turbines to periods when the wind speed reaches a pre-determined speed that is greater than the manufacturer's recommended cut-in speed and feathering turbine blades into the wind below that set wind speed. "Feathering" means that the wind turbine blades are pitched parallel to the wind, resulting in very slow movement of the rotor, on the order of 1 to 3 rotations per minute depending on blade length. Nighttime LWSC has been associated with reduction in risk to bats (Arnett et al. 2011) because bat activity is typically associated with periods where wind speeds are lower. As wind speeds increase, the likelihood of bat activity decreases, and collision risk correspondingly decreases.

Despite the benefit of LWSC, the risk to bats posed by wind turbines cannot be eliminated without full nighttime shutdown. Complete, dusk to dawn, year-round shutdown is typically not feasible, as it could reduce power output to levels below that necessary to maintain economic feasibility and compliance with applicable PPA requirements of a project. Full nighttime shutdown is evaluated as an alternative in Section 8.1.

In 2010, barbed wire fences were the greatest known source of Hawaiian hoary bat fatalities (Zimpfer and Bonaccorso 2010). Annual mortality estimates range from zero to 0.8 Hawaiian hoary bats per 62 miles of barbed wire. It is believed Hawaiian hoary bats are more vulnerable to barbed wire fences that occur in open and forest edge areas than in heavily cluttered forested areas. Tree removal has the potential to impact juvenile bats because they may be unable to fly away from a tree when it is cut or disturbed; however, it is not known how much bat take occurs as a result of tree trimming and harvesting (DOFAW 2015). To address the threats posed by barbed wire and tree removal, several additional minimization measures are recommended by USFWS and DOFAW. Avoiding the use of barbed wire where possible when installing fencing or other such structures can reduce this source of mortality. USFWS recommends using smooth wire when replacing barbed wire fencing. Impacts to pups in roosting trees can be avoided or minimized by not removing trees during the pupping season.

The greatest unquantified threats to Hawaiian hoary bats are from habitat loss, fire, pesticides, reduction in prey, and predation (USFWS 1998, USFWS 2011). These threats may be widespread across the state, and can result in direct and indirect mortality, reduced reproductive success, and reduced distribution of the Hawaiian hoary bat. Finally, records from the mainland indicate that bats are susceptible to being trapped and drowned in troughs, tanks, and pools with steep sides (Boyle 2014, Taylor and Tuttle 2007, Taylor 2007).

Despite the status as endangered, the Hawaiian hoary bat appears to have a low risk of extinction. The bat was listed as endangered in 1970, largely based on a lack of information. Since the Hawaiian hoary bat was listed as endangered, the population has persisted without direct action taken to promote the survival of the species. At the time, USFWS assigned the Hawaiian hoary bat a "recovery priority number of 9, indicating a subspecies with a moderate degree of threat and a high potential for recovery" (USFWS 1998). The interim down-listing criteria is defined by the USFWS (USFWS 1998) as, "Hence, downlisting can occur when the population on Hawaii is determined to be stable or increasing for at least five consecutive years." The down-listing criteria outlined in the USFWS Hawaiian Hoary Bat Recovery Plan (USFWS 1998) was met with the publication of the five-year occupancy study from Hawaii island (Gorresen et al. 2013). When a species reaches it's down-listing criteria, it is an indication that the recovery goals for the species have been met, and the service considers changing the listing status such as from endangered to threatened.

Overview of Impacts Associated with Wind Energy in Hawai'i

Across the continental United States, the mainland hoary bat is one of the bat species most frequently killed by wind turbines, primarily during fall migration (Kunz et al. 2007, Arnett et al. 2008). Hawaiian hoary bats do not have long-distance migration movements which are characteristic of mainland hoary bats. As a result, Hawaiian hoary bats may be less susceptible to fatality at wind turbines than mainland hoary bats, because Hawaiian hoary bats tend to approach wind turbines less frequently than their more migratory mainland conspecifics (Gorresen et al. 2015). For the wind farms in Hawai'i with approved HCPs, post-construction mortality monitoring data from January 2006 through December 2017 indicate that 32 of 70 (45.7 percent) observed fatalities of Hawaiian hoary bats occurred in August and September, and at least one fatality occurred during each other month of the year (DOFAW 2018). However, the seasonal patterns in the fatalities are at least partially a result of the disproportionate number of observed Hawaiian hoary bat fatalities that have occurred at the Project on Maui and the Kawailoa Wind Farm on O'ahu. Overall, these data suggest the Hawaiian hoary bat is vulnerable to collision with wind turbines throughout the year, and that the temporal distribution of fatalities is likely dependent on multiple site-specific factors (e.g., the island where the project is located, habitat, elevation), and potentially the influx of newly volant young that may occur in August and September. Therefore, project-specific post-construction mortality monitoring data are the best predictor of seasonal patterns of future take, and the most informative when developing avoidance and minimization measures.

3.8.1.3 Occurrence in the Project Area

A variety of studies have documented the occurrences of the Hawaiian hoary bat on Maui as shown in Figure 3-4. The locations shown are a compiled list of bat detections, captures, or observations from three studies, observations from three wind farms or associated mitigation areas, and four incidental or other types of observations largely over the last 10 years. Four observations date back to 1970, as shown in Table 3-1. The locations where no bat detections were recorded are not shown, because the sampling effort differs between locations and the absence of detections does not mean an absence of bats (Gorresen et al. 2017). The detections on Maui are predominantly associated with accessible areas; thus, as more efforts are made to detect bats, they will likely be documented in additional locations across Maui.

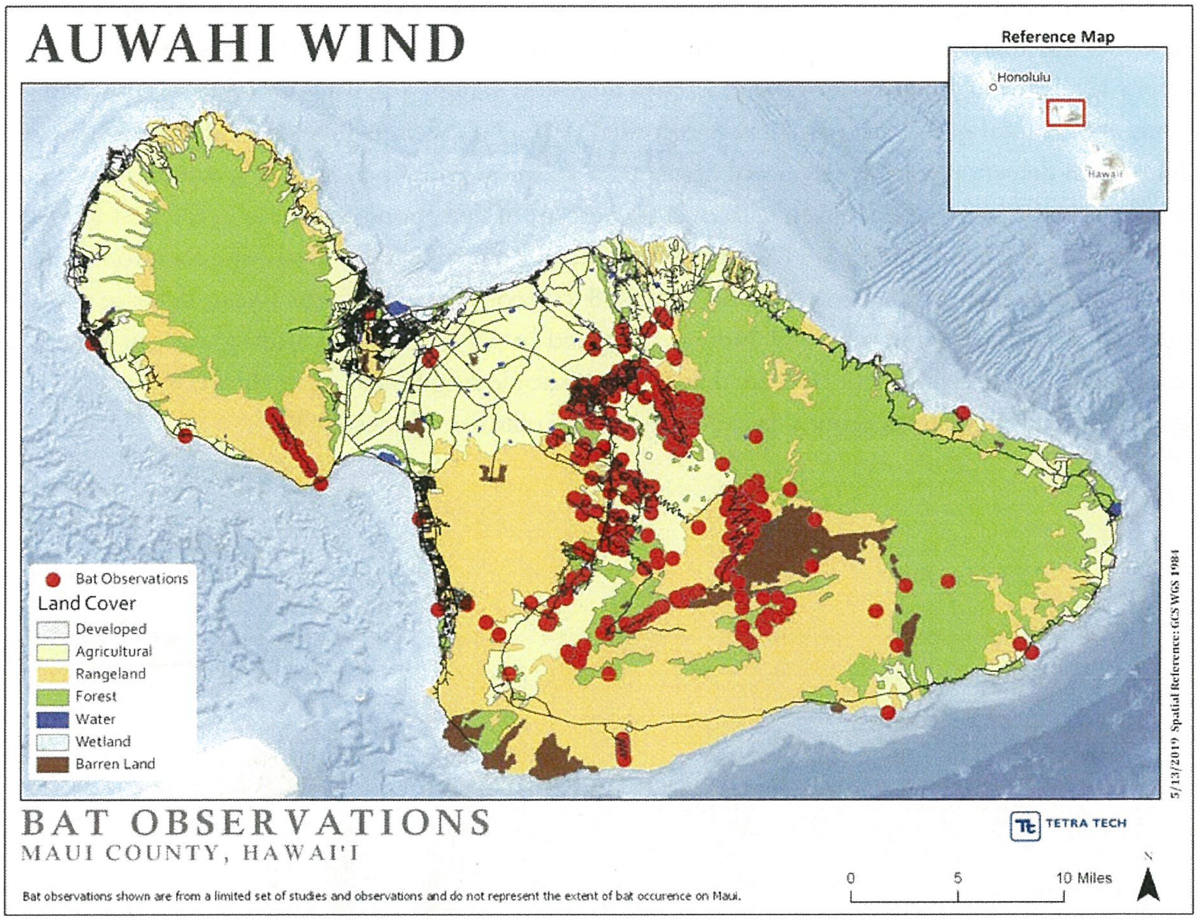


Figure 3-4. Documented Acoustic Bat Detections on Maui in Relation to Land Cover and Roads.

Table 3-1. Locations and Studies that Document Hawaiian Hoary Bat Observations on Maui as shown in Figure 3-2.

Location	Citation
Pu'u Kukui Preserve	DLNR 2005
Kahikinui Forest Reserve/Nakula Natural Area Reserve	Todd et al. 2016
Haleakalā National Park	Fraser et al. 2007
Auwahi Wind	Auwahi Wind 2017, Auwahi Wind 2018
Kaheawa Wind	KWP I 2017, KWP II 2017
Ulupalakua Ranch	Auwahi Wind 2017
Waikamoi	The Nature Conservancy 2011
Nu'u	Haleakalā National Park 2016
Olinda	Starr Environmental 2010
Kihei, Kahului, Lahaina, Leeward and Windward Haleakalā	USFWS 1998
West Haleakalā	H.T. Harvey and Associates 2019

Acoustic monitoring conducted at the Project using two ground-level acoustic monitors (Wildlife Acoustics SM2Bat+) placed at WTG 1 and WTG 6[4] from 2013 through 2015 documented low bat activity levels throughout most of the year, with increased activity August – October as shown in Figure 3-5. A total of 371 bat passes were recorded in 1632 detector nights (0.23 bat passes per night), with detections on 31 percent of nights over the monitoring period. The number of bat passes peaked 3 hours after sunset, with over 90 percent of detections occurring in the first 6 hours after dark, as shown in Figure 3-6 (Auwahi Wind 2015). Four nacelle-level acoustic monitors were placed at the Project at WTGs 2, 4, 5 and 7 in 2018 to record bat activity for 1 year; data are expected to be available in late 2019. Note that ground-based acoustic monitoring was not used as a proxy for risk at nacelle height because detections at nacelle height have been shown to be significantly different from ground-based detections (Collins and Jones 2009).

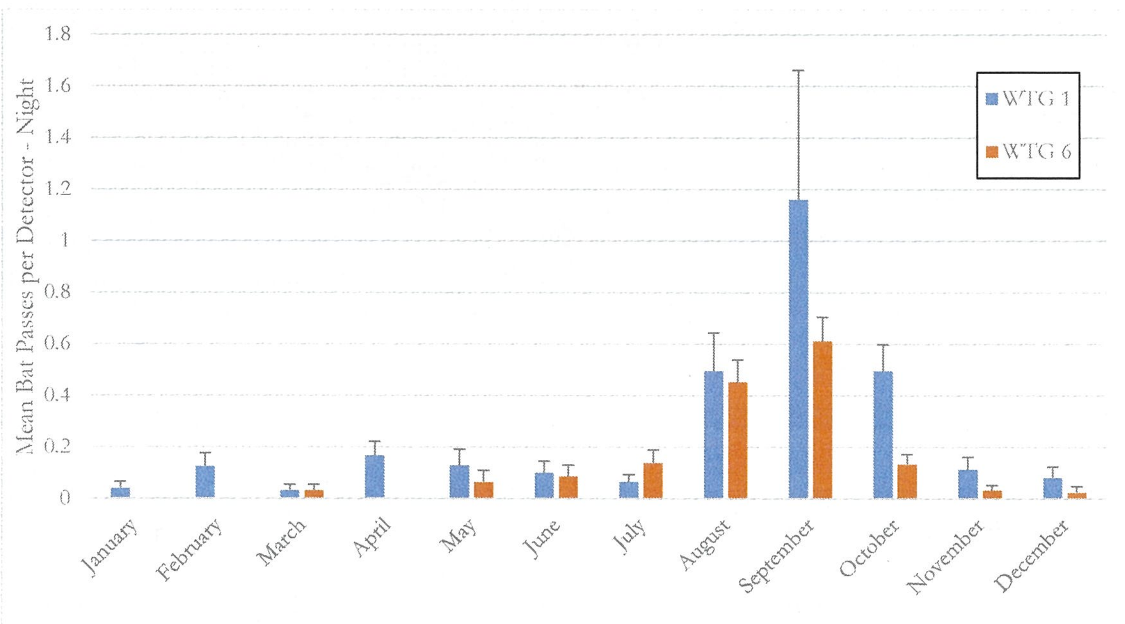


Figure 3-5. Acoustic data by month from ground detectors, 2013-2016.

[4] Turbines are numbered sequentially starting with the northernmost turbine being turbine 1, and the southernmost turbine being turbine 8.

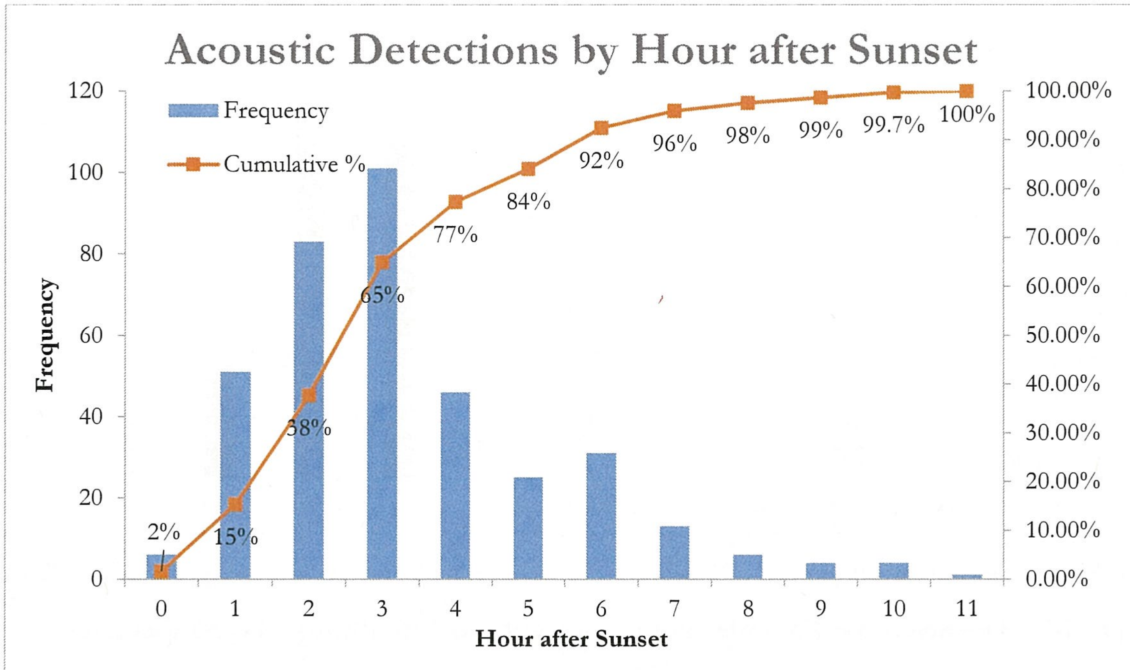
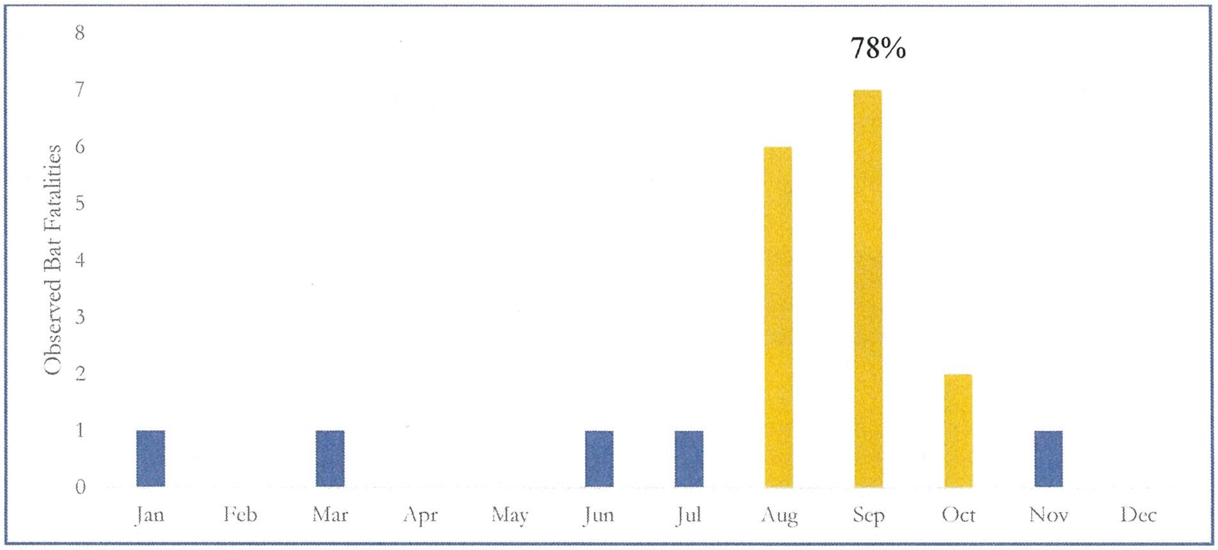


Figure 3-6. Acoustic data binned by hour after sunset from ground detectors, 2013-2016.

Post-construction mortality monitoring at the Project suggests a similar seasonal pattern in bat use based on the corresponding number of fatalities (Auwahi Wind 2013, Auwahi Wind 2014, Auwahi Wind 2015, Auwahi Wind 2016, Auwahi Wind 2017), as shown in Figure 3-7. As of December 31, 2017, 18 Hawaiian hoary bat fatalities have been documented; 16 of these fatalities were observed during post-construction mortality monitoring, and two were observed incidentally (outside search plot or regular search interval). Fourteen of the 18 observed fatalities (78 percent) occurred between August and October. Genetic determination of gender has been conducted by the U.S. Geological Survey (USGS) for 12 of the observed fatalities; their results indicate that approximately 50 percent of the fatalities were male and 50 percent female.



Note: Yellow bars indicate 78 percent of fatalities have occurred in the period from August through October.

Figure 3-7. Observed Bat Fatalities at the Project from 2013 through December 2017.

The variable timing of bat fatalities among the operational wind projects suggests that project-specific factors (e.g., topography or vegetation) influence bat fatality patterns. However, sample sizes are small, and no definitive conclusions can be drawn at the present time. The Project site is a relatively lowland location with elevations between 900 and 3,800 feet (Figure 1-2). Research from Hawai'i Island suggests that bats normally occupy higher elevations during the non-breeding season. Observation of fatalities during the non-breeding season suggest that there may also be island-specific factors that influence temporal trends in bat fatalities.

Based on observed fatalities at the Project, there may be inter-annual variability in Project take. During the first 3 years of monitoring (2013-2015), the number of observed bat fatalities per year was 1, 4, and 1, respectively. In 2016, seven bat fatalities were observed during systematic monitoring, despite the implementation of LWSC with a cut-in speed of 5.0 m/s, year-round. In 2017, three fatalities were observed during systematic monitoring. Overall detection probability estimated by EoA increased from 0.28 in year 1 to between 0.45 and 0.66 for all remaining years due to increases in search intensity and implementation of predator control. Average detection probability for all years of monitoring (2013-2017) is 0.5, with a standard deviation of 0.11, indicating that the number of observed fatalities per year is comparable among years. Appendix H contains more detailed information on the detection probability and estimation process. The causes of any inter-annual variability are unknown. Anecdotal data from 2016 suggest that causes of inter-annual variability may include anomalous weather patterns, drought cycles, or other phenomena. The average number of observed fatalities over the 5 years of monitoring is 3.2 observed fatalities per year. Therefore, 2017 represents a return to the average value.

For the Project, average monthly wind speeds recorded from dusk to dawn between years 2014 - 2018 ranged from 6.25 to 9.18 meters per second as seen in Figure 3-8. No correlation was found between fatalities and the wind regime at the site; average wind conditions during the three months (August through October) of highest bat fatalities at the Project were not lower than other months of the year. The lowest average wind speeds occurred in the months of January and February. For months with few observed fatalities, the risk to Hawaiian hoary bats is minimal, suggesting that additional wind turbine curtailment in these periods would not significantly reduce collision risk.

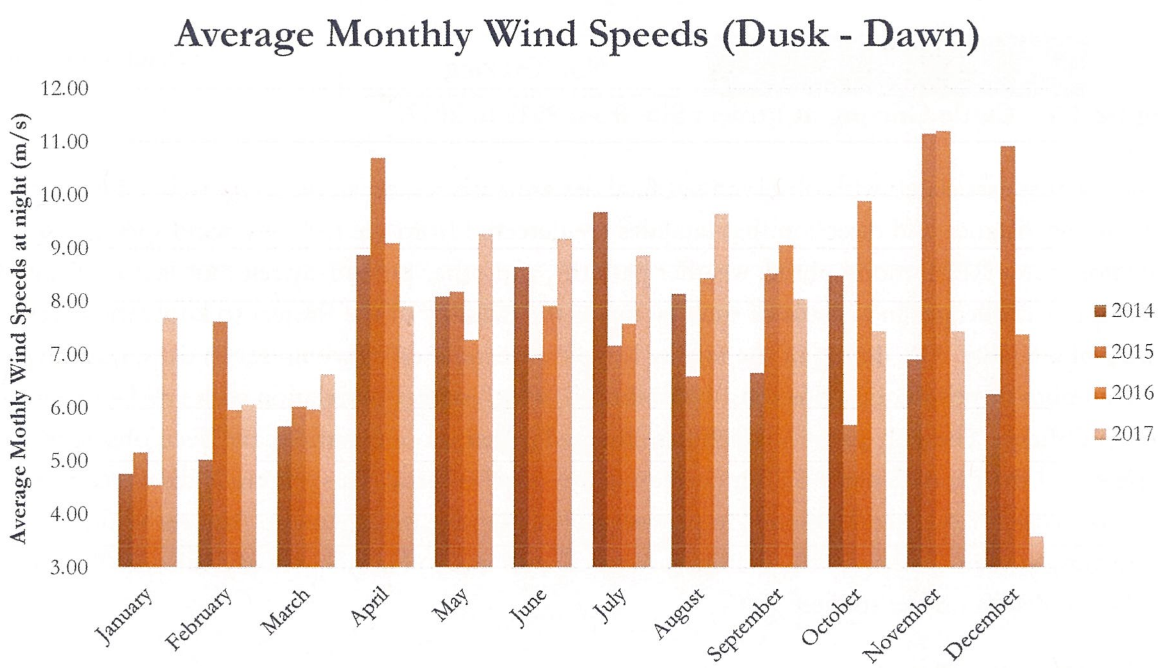


Figure 3-8. Wind Regime from Dusk to Dawn at Project Site from 2014-2017.

Another factor analyzed to help assess any potential patterns of observed bat fatalities was whether cattle were grazing in the Project area around the time of the reported bat fatalities. As illustrated by Figure 3-9, approximately 28 percent of observed fatalities have coincided with the grazing and 30-day post grazing period. The 30-day post grazing period accounts for insect abundance associated with cattle dung after the cattle have been removed.

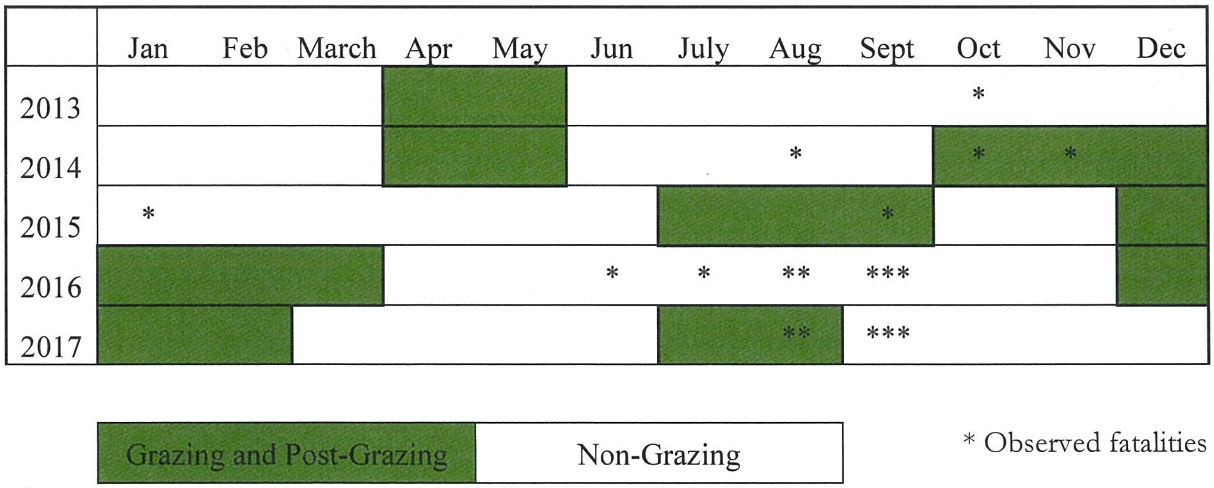


Figure 3-9. Cattle Grazing at Project Site from 2013 to 2017.

Other factors associated with observed bat fatalities are analyzed on an ongoing basis. These factors include the distance and direction that fatalities are detected from the turbines, wind speed, wind direction, rotor RPM, moon phase, weather patterns, and other potentially relevant factors. One of the primary challenges in analysis of such factors is the inability of the Project to know the exact timing of a fatality. The timing of the fatality is typically estimated to within seven days, meaning a large number of prior conditions must be evaluated, which makes correlation with any factor or factors difficult. The only pattern which has emerged is that more fatalities have been observed at turbines 1-4 than at turbines 5-8 after correcting for searched area. This pattern is discussed in more detail in Section 7.4.1.3 and included in provisions for adaptive management. Auwahi Wind is conducting studies to identify the factors associated with risk to Hawaiian hoary bats; see Section 7.4.1.2 for details on the studies.

3.8.2 Hawaiian Petrel

This section requires no edits for the HCP Amendment.

3.8.3 Nene

This section requires no edits for the HCP Amendment.

3.8.4 Blackburn's Sphinx Moth

This section requires no edits for the HCP Amendment.

3.9 OTHER RESOURCES

This section requires no edits for the HCP Amendment.

4.0 GOALS AND CONSERVATION MEASURES

This section requires no edits for the HCP Amendment except as provided in the subsections below.

4.1 BIOLOGICAL GOALS AND OBJECTIVES

In addition to the biological goals and objectives of the approved HCP, the following provides biological goals and objectives for the HCP Amendment for the Hawaiian hoary bat.

4.1.1 Goals

Biological goals are intended to be broad, guiding principles that clarify the purpose and direction of the HCP (USFWS and NMFS 2016). The biological goals for the HCP Amendment are:

- Minimize impacts to the Hawaiian hoary bat to the maximum extent practicable in the Project area; and
- Mitigate remaining impacts to fully offset impacts and provide a net benefit to the Hawaiian hoary bat by protecting, enhancing and/or managing Hawaiian hoary bat foraging and/or roosting habitat.

4.1.2 Objectives

Biological objectives are derived from the goals and provide the basis for determining strategies, monitoring effectiveness and evaluating the success of actions (USFWS and NMFS 2016). The biological objectives for achieving the HCP Amendment goals are:

- Implement strategic minimization measures, and as needed, additional minimization actions at defined time periods according to a clear adaptive management plan, to reduce Hawaiian hoary bat take and ensure total permitted take is not exceeded for the remainder of the permit term; and
- Implement a mitigation project or projects that will protect, manage and/or enhance Hawaiian hoary bat habitat on Maui or within Maui Nui to promote foraging, roosting, and/or breeding habitat through the removal of threats or the addition of features necessary for those stages of the Hawaiian hoary bat life cycle.

Avoidance, minimization, and mitigation measures that will be used to achieve these goals and objectives, and the measures of success are described in detail in the subsequent sections of this HCP Amendment.

4.2 AVOIDANCE AND MINIMIZATION OF IMPACTS

This section requires no edits for the HCP Amendment.

4.2.1 General Project Development Measures

This section requires no edits for the HCP Amendment.

4.2.2 Pre-construction Surveys and Timing Considerations

This section requires no edits for the HCP Amendment.

4.2.3 Project Components and Siting Considerations

This section requires no edits for the HCP Amendment.

4.2.4 Invasive Plant Species Management

This section requires no edits for the HCP Amendment.

4.2.5 Fire Prevention During Construction and Operation

This section requires no edits for the HCP Amendment.

4.2.6 Measures to Minimize Environmental Impacts

This section requires no edits for the HCP Amendment.

4.2.7 Operational Avoidance and Minimization Measures for the HCP Amendment (New HCP Amendment Section)

Auwahi Wind is committed to reducing the risk of bat fatalities at the Project. Auwahi Wind considered the current literature from the mainland and recommendations in the ESRC Bat Guidance (DOFAW 2015) for identifying appropriate minimization measures for bats. LWSC is considered the best measure at this time to minimize impacts to bats while taking into consideration site-specific wind conditions and Project-specific energy generation or PPA requirements.

LWSC, as noted in Section 3.8.1.2, has been demonstrated to show a statistically significant reduction in bat fatalities. Based on current turbine technology, initiation of LWSC is determined by a 10-minute running average of wind speeds collected at the turbine nacelle. During curtailment, blades are feathered, reducing the speed of the blade to less than one RPM. Turbines take approximately 10 seconds to reach this rate of rotation when curtailment is initiated, and approximately 90 seconds to leave curtailment mode (depending on wind speeds, wind farm power output, and voltage/frequency requirements).

In response to the Project post-construction mortality monitoring results, Auwahi Wind began experimenting with LWSC regimes as adaptive management minimization measures to reduce impacts to the Hawaiian hoary bat, starting in late 2014. These measures are described below:

- Between November 2014 and January 2015, Auwahi Wind voluntarily implemented an operational protocol under which turbine blades were feathered below the manufacturer's recommended cut-in wind speed of 3.5 m/s, from at least 1 hour before sunset to at least 1 hour after sunrise.
- Beginning in February 2015, Auwahi Wind initiated voluntary year-round curtailment by feathering turbine blades at wind speeds below 5.0 m/s, from at least 30 minutes before sunset to at least 30 minutes after sunrise.

However, in 2017 when bat take was projected to exceed the ITP/ITL authorized take limit, Auwahi Wind reviewed and updated the analysis of the best available information from the mainland to identify alternative LWSC regimes that could further reduce risk to bats. The primary means of increasing the effect of LWSC on potential impacts to bats is to increase the wind speed at which turbines return to service. As summarized in Table 4-1, estimates of the impact of LWSC regimes from studies on the mainland suggest a reduction in bat take ranging from 10 to 92 percent. Figure 4-1, below, applies a best fit regression analysis of percent reduction in bat fatalities for a given cut-in speed, as depicted by the dotted line. The analysis shows that above a certain point, increases in cut-in speed do not result in commensurate further increases in fatality reductions. For example, there is less than a 0.3 percent reduction in bat fatalities above cut-in speeds of 6.9 m/s. Although there is a theoretical maximum reduction of bat fatalities from the regression, extrapolation from such a dataset should be done with caution because there are numerous variables (e.g., site, wind regime, bat abundance, bat species) in addition to the LWSC, which may contribute to variation in bat fatality rates between sites, or treatments. Thus, the regression analysis predicts that increasing cut-in speeds above 6.9 m/s provides insignificant increases in risk reduction, making a LWSC regime of 6.9 m/s the maximum extent practicable for cut-in speed, based on the literature review. A summary of current literature on the effectiveness of LWSC is provided in Appendix G.

The regression analysis in Figure 4-1 indicates that a LWSC cut-in speed of 6.9 m/s should reduce the risk of bats fatalities by 76 percent. Similarly, a Technical Assistance Letter from the USFWS in response to the Draft Headwaters HCP, and Pioneer Trail Bird and Bat Conservation Strategy suggests that a LWSC cut-in speed of 6.9 m/s is sufficient avoidance that take of Indiana bats (*Myotis sodalis*) would not be expected (Headwaters Wind Farm 2018, Stantec 2015). Increases in LWSC cut-in speed beyond 6.9 m/s are not anticipated to have a significant impact on the risk to bats. Studies looking at the impacts of LWSC have used 6.9 m/s as the maximum cut-in speed; at this time there are no publicly available studies looking at higher cut-in speeds.

Observations of bat fatalities at the Project vary seasonally and post-construction mortality monitoring implemented by Auwahi Wind indicates that 78 percent (14 of 18) of observed fatalities at the Project have occurred in the months of August to October. Therefore, this timeframe (August 1 through October 31) was selected as the period of highest risk at the Project, and the period to prioritize for maximum risk reduction effort (i.e., most aggressive LWSC regime). As derived from the regression in Figure 4-1 and using a percent reduction in bat fatalities of 76 percent (based on implementing LWSC at 6.9 m/s year-round), applying LWSC at 6.9 m/s during the 3-month period of maximum risk (representing 78 percent of the observed take) results in an estimated 59 percent (76% x 78% = 59%) reduction in take rate.

The other key element of a LWSC regime is seasonal application of selected cut-in speeds. Seasonal adjustment of cut-in-speeds has been used at wind facilities on the mainland to minimize impacts to listed bat species such as Indiana bats and northern long-eared bats (*Myotis septentrionalis*). For example, some wind facilities will raise the cut-in speed to 5.0 m/s during the fall migration period (August 1 to October 15) or consider other seasonal adjustments as part of an adaptive management program (Stantec 2015). USFWS had deemed these appropriate avoidance and minimization measures for these listed bat species (WEST 2013, Stantec 2016). Although there is not a traditional migratory pattern in Hawai'i for Hawaiian hoary bats, there are seasonal movements that have been documented in the literature, acoustic data, and observed fatalities (Todd 2012, Bonaccorso et al. 2015, Kawailoa Wind Power 2017, Auwahi Wind 2015). From data observed at the Project and some other wind projects in Hawai'i, there generally appears to be a greater risk to bats in the months from June to November. At the Project, 5 years of post-construction mortality monitoring (2013-2017) indicates that 78 percent of observed fatalities have occurred in the months of August to October.

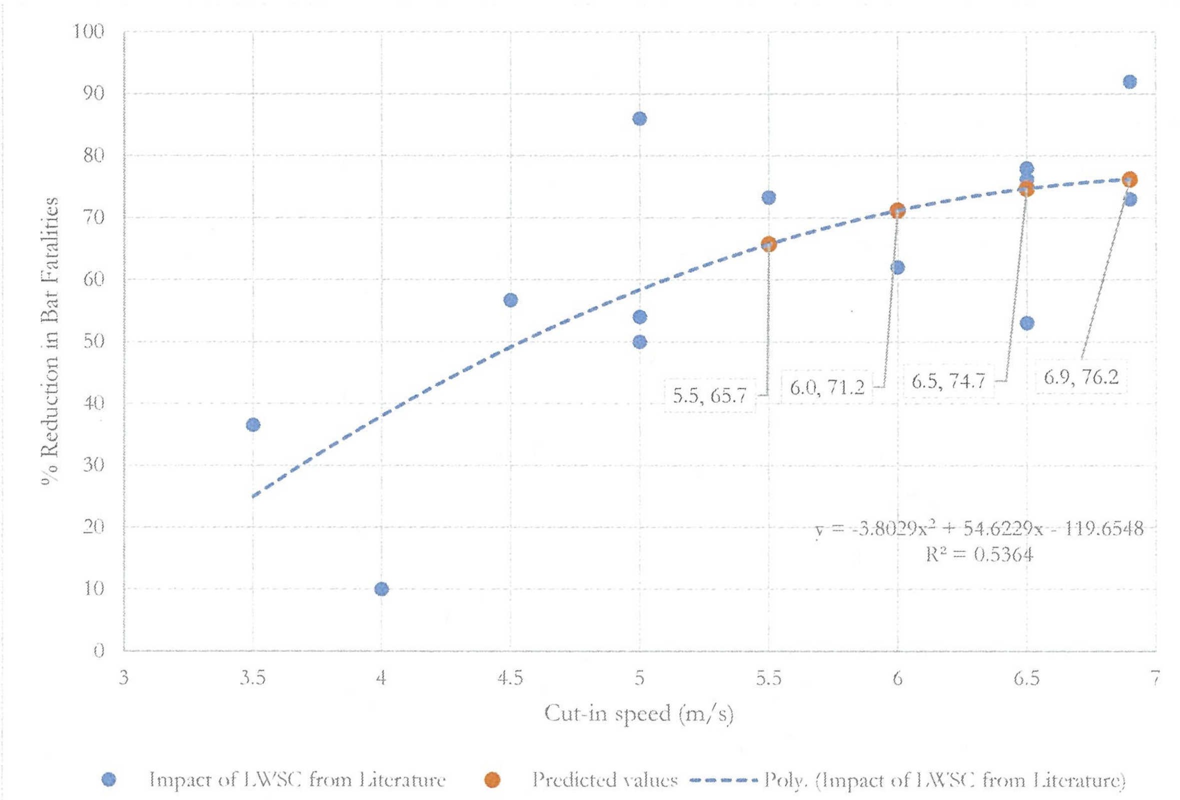


Figure 4-1. Synthesis of Low Wind Speed Curtailment Impact on Bat Fatalities

Table 4-1. Regression Analysis Data Used to Synthesize LWSC Impact on Bat Fatalities in Figure 4-1

Normal Cut-In Speed (m/s)	Treatment (m/s)	Percent Reduction (%)	Facility and Location	Analysis from Multi-species of Bats	Hoary Bats Included in Analysis	References
3.5	6.9	92	Laurel Mountain Wind Energy Project WV	Yes	Yes	Stantec 2015
3	5	54	Pinnacle Wind, WV	Yes	Yes	Hein et al. 2014
3	6.5	76.2	Pinnacle Wind, WV	Yes	Yes	Hein et al. 2014
4	6	62	Sheffield Wind Facility, VT	Yes	Yes	Martin et al. 2017
NA	6.9	73	Beech Ridge, WV	Yes	Yes	Tidhar et al. 2013
0	3.5	36.5	Fowler Ridge, IN	Yes	Yes	Good et al. 2012
0	4.5	56.7	Fowler Ridge, IN	Yes	Yes	Good et al. 2012
0	5.5	73.3	Fowler Ridge, IN	Yes	Yes	Good et al. 2012
0	4	10	Mount Storm, WV	Yes	Yes	Young et al. 2012
3.5	5	50	Fowler Ridge, IN	Yes	Yes	Good et al. 2011
3.5	6.5	78	Fowler Ridge, IN	Yes	Yes	Good et al. 2011
0	5	86	Casselman, PA	Yes	Yes	Arnett et al. 2011
0	6.5	53	Casselman, PA	Yes	Yes	Arnett et al. 2011

To have a likelihood Hawaiian hoary bat take, bats must be present at the wind farm while turbines are operating. Auwahi Wind developed its LWSC program to incorporate a seasonal approach, focusing on the periods of greatest risk to the bats at Auwahi to minimize impacts of incidental take to the maximum extent practicable. Auwahi Wind determined that it can implement a LWSC regime of 6.9 m/s during the 3 months (August through October) of highest bat fatalities at the Project based on the 5 years of post-construction monitoring (described below in more detail) and apply a LWSC regime of 5.0 m/s the remainder of months (November through July) when risk is lower. Auwahi Wind evaluated pertinent data on the months in which risk to bats is low. From the start of operation through December 2017, no fatalities were observed in the months of February through May, and December. One fatality was found in each of the months January, June, July, and November. The period of highest risk for bat fatalities at wind energy facilities tends to occur during relatively low-wind conditions (Arnett et al. 2008).

Auwahi Wind implemented the following as initial minimization measures starting in 2018 and will continue to do so for the duration of the permit, unless specific adaptive management triggers are reached that would initiate an adaptive management action. These minimization measures are:

- Implement LWSC for all eight turbines with a 5.0 m/s cut-in speed November through July (all months without LWSC at higher cut-in speeds), from 30 minutes before sunset to 30 minutes after sunrise; and
- Implement increased nighttime LWSC with a 6.9 m/s cut-in speed for all eight turbines, from 30 minutes before sunset to 30 minutes after sunrise, for the months of August to October (that is, the period for which data from the first 5 years of operation show that most bat fatalities have occurred).

Adaptive management of this operational avoidance and minimization strategy is discussed in Section 7.4.1. Alternative minimization strategies considered but not implemented are discussed in more detail in Section 8.

5.0 ASSESSMENT OF POTENTIAL IMPACTS AND TAKE LIMITS

Estimates of direct take and indirect take collectively inform the amount of additional take requested under this HCP Amendment (Section 5.1.3). Due to the uncertainty related to estimating take over the long term, the approved HCP developed a tiered approach for structuring requested take and associated mitigation. Under this HCP Amendment, three additional tiers of Hawaiian hoary bat take (Tiers 4 – 6) have been added to the three approved tiers. Tier structuring and triggers for initiating mitigation are described in detail in Section 5.1.3 and Section 6.2.5, respectively. The estimated take of other Covered Species has not been revised from the information presented in Sections 5.2 through 5.4 of the approved HCP.

5.1 HAWAIIAN HOARY BAT

Impacts to Hawaiian hoary bats associated with wind farm operation are described in Section 5.1 of the approved HCP. Collision risk has been verified through the results of post-construction mortality monitoring programs that have been implemented at the five Hawai'i wind farms that possess approved HCPs, including data collected since 2012 at the Project (see Section 3.8.1.3 for a summary of take observed through December 31, 2017). Despite the implementation of avoidance and minimization measures such as LWSC, the data show that at KWP II, Kawailoa Wind, and at the Project, the initially authorized ITP/ITL take limits have been exceeded. As a result, each of these wind farms are in the process of amending their HCPs to provide ITP/ITL coverage for additional bat take. KWP I and Kahuku wind farms are implementing their HCPs without requesting amendments.

Project-specific monitoring data were used in this HCP Amendment to predict take over the assumed 20-year operational period of the Project (December 2012 – 2032), consistent with the Project's current PPA. As noted in Section 2.2, the term of the ITP/ITL is 25 years (through 2037), which includes five years during which Auwahi Wind may consider extending the operational life of the Project through a new or revised PPA. Assuming the authorized take limits have not been reached, legal coverage under the ITP/ITL would remain in effect during this period.

5.1.1 Direct Take for the HCP Amendment

For this HCP Amendment, Auwahi Wind used the number of observed fatalities and monitoring detection bias (detection probability) from five complete years (2013 – 2017) of Project-specific post-construction mortality monitoring to predict future direct take. Search interval, searched area, carcass persistence, and searcher efficiency are used to inform the detection probability. Detection probability is used to adjust the number of observed fatalities to account for unobserved take. The projection of future take therefore accounts for uncertainty in the detection of carcasses, and the projection provides an estimate of take over the remaining years of the permit term.

To predict direct take over the 20-year operating life of the Project, the multi-year analysis module in the current EoA software (version 2.0, Dalthorp et al. 2017) was used to incorporate the post-construction mortality monitoring data collected through December 2017. The EoA software is the state-of-the-art analysis tool currently being employed by USFWS and DOFAW to evaluate compliance with the ITP/ITL, and therefore is currently the most appropriate tool for predicting direct take. Input parameters are provided in Table 5-1. An underlying assumption for this analysis is that detection probability and fatality rates derived from post-construction mortality monitoring are representative of future years. Using the current USFWS and DOFAW ITP/ITL compliance standard, the 80 percent upper credible limit value output from EoA is assumed to represent the credible maximum number of fatalities that could occur over the life of the Project. Using data from Project monitoring through December 31, 2017 it can be asserted with 80 percent certainty that Project-related direct take through 2017 does not exceed 38 bats. Using the same data to predict future take, the EoA model predicts a total direct take of 162 bats through the remainder of the ITP/ITL term if no additional minimization measures are implemented (i.e., baseline).

As described in Section 4.2.7, Auwahi Wind estimates that curtailment with a cut-in speed of 6.9 m/s for the months of August to October will reduce the fatality rate by 59 percent. However, there is uncertainty in extrapolating the effectiveness of LWSC in reducing bat fatalities from mainland studies on several bat species to the effectiveness of LWSC on the Hawaiian hoary bat. Data on the effectiveness of LWSC on bats in Hawai'i are lacking due to the relatively low number of fatalities (insufficient sample size precluding statistical analysis) or because some wind farms have implemented LWSC since the start of commercial operation, precluding a before/after comparison. The actual reduction in take rate at the Project may vary (higher or lower) from the modeled data.

To account for the uncertainty in the effectiveness of LWSC in reducing the risk to Hawaiian hoary bats, Auwahi Wind conservatively assumed a minimum 30 percent reduction of future direct take. The baseline EoA model was then modified to account for a minimum 30 percent reduction in future direct take by implementing this LWSC regime. As shown in Table 5-1, and based on assumptions described here, it can be asserted with 80 percent certainty that total Project-related direct take through 2032 will be no more than 129 bats with implementation of this LWSC regimen. This updated direct take estimate reflects only a reduction in take for future years, not an overall reduction of 30 percent from 162 bats. See Appendix H for additional detail on the take estimate and EoA software, including an explanation of the analysis periods and relative weights. This take estimate represents the highest level of direct take that would be anticipated given the monitoring data through December 2017. Considering the conservative 30 percent reduction of take applied due to minimization measures, the actual direct take will likely be lower than the 129 bats predicted.

Table 5-1. Predicting Bat Take: Model Input Parameters for EoA Multi-Year Analysis Based on 5 Years of Project Monitoring

Analysis Period Dates	Number of Fatalities Observed[1]	Detection Probability ($\hat{g}$)[2]	$\hat{g}$ Lower	$\hat{g}$ Upper	Relative Weight[2]	Basis for Values
January–December 2013	1	0.282	0.216	0.352	12	Post-construction mortality monitoring data January – December 2013
January 2014 – January 2015	4	0.548	0.445	0.648	13	Post-construction mortality monitoring data January 2014 – January 2015
February – December 2015	1	0.451	0.378	0.525	11	Post-construction mortality monitoring data February – December 2015, Period begins with implementation of LWSC at 5.0 m/s cut in speed.
January–December 2016	7	0.549	0.463	0.634	12	Post-construction mortality monitoring data January – December 2016
January –March 2017	0	0.668	0.592	0.74	3	Post-construction mortality monitoring data January – March 2017, Period ends with the end of the 3-day search interval
March – December 2017	3	0.58	0.479	0.677	9	Post-construction mortality monitoring data March – December 2017, 4-day search interval
January 2018 – December 2032	NA[3]	0.571	0.485	0.652	8.4 [3]	Estimated based on post-construction mortality monitoring data using canine search teams, minimum reduction (30 percent) in future fatalities expected for implementation of additional minimization measures (12 months * 70% = 8.4 relative weight)

1. Observed take counts only those fatalities observed in systematic monitoring. Carcasses found incidentally are accounted for through EoA modelling.
2. Detection probability and relative weights are inputs into the EoA software for projecting total Project Hawaiian hoary bat take over the permit term. Relative weights are months used in analysis.
3. Years over which take predicted; observed fatalities yet to be determined.

5.1.2 Indirect Take for the HCP Amendment

The direct take of an adult female bat during the time when young are dependent on her may result in the indirect loss or take of dependent offspring. The following variables used to predict the magnitude of this indirect take are based on parameters recommended in USFWS and DOFAW guidance (USFWS 2016a):

- A conservative estimate of direct take (Section 5.1.1);
- The proportion of take assumed to be adult females (only female bats care for young);
- The proportion of fatalities occurring during the period when young bats are dependent;
- The probability that the loss of a reproductively active female results in the loss of her offspring;
- The average reproductive success rate; and
- The proportion of young that survive to reproductive age.

The rationale and values used to predict indirect take are outlined in Table 5-2 and result in an indirect take prediction of 11 adult-equivalent bats during 20 years of operation. Because current mitigation frameworks only provide guidance relative to adult bats, indirect take was adjusted to bats (adults) by multiplying the predicted number of indirectly taken juveniles by the probability those juveniles would survive to become adults (Table 5-2, Line Numbers 2 through 5).

Table 5-2. Indirect Take Estimate Derived for Hawaiian Hoary Bat, Combined with the New Estimated Future Direct Take (observed and unobserved) for the HCP Amendment

Line Number	Component	Calculation of Count	Number of Bats	Calculation of Indirect Take[1]	Indirect Take Assessment
1	Observed[2] male fatalities, or observed fatalities outside the breeding season	Observed	8	No impact to dependent young, multiply by 0	0
2	Observed[2] female fatalities within the breeding season	Observed	2	Multiply by estimated reproductive rate 1.8 * proportion of offspring surviving to adulthood 0.3	1.08
3	Observed[2] fatalities of unknown sex within the breeding season	Observed	6	Multiply by proportion of population assumed to be female 0.5 * estimated reproductive rate 1.8 * proportion of offspring surviving to adulthood 0.3	1.62
4	Unobserved fatalities	38 estimated at 80% CI using EoA[3] minus 16 observed	22	Multiply by proportion of the population assumed to be taken with dependent young 0.25 * proportion of population assumed to be female 0.5 * estimated reproductive rate 1.8 * proportion of offspring surviving to adulthood 0.3	1.49
5[4]	Future direct take (unobserved)	129 predicted at the 80% CI using EoA[3] minus 38 current take estimated at the 80% CI	91	Multiply by proportion of the population assumed to be taken with dependent young 0.25 * proportion of population assumed to be female 0.5 * estimated reproductive rate 1.8 * proportion of offspring surviving to adulthood 0.3	6.14
6	**Future Indirect take**	Sum the indirect take assessment for line numbers 1-5, rounded up to the nearest whole number	11	Sum the indirect take assessment for line numbers 1-5, rounded up to the nearest whole number	11
7	**Total take estimated at the 80% CI**	Sum the count for line numbers 1-6	**140[5]**		

1. Calculations based on USFWS Wildlife agency guidance for calculation of Hawaiian hoary bat indirect take, unless otherwise noted.
2. Observed take counts only those fatalities observed during systematic monitoring. Carcasses found incidentally are accounted for through EoA modelling.
3. Dalthorp et al. 2017.
4. Calculations of future indirect take are based on USFWS guidance and actual estimates of indirect take will depend on the timing and gender of observed fatalities.
5. The total take estimate includes 21 bats authorized under the approved HCP and 119 additional bats requested in the HCP Amendment.

5.1.3 Authorized Take Request for the ITP/ITL for the HCP Amendment

Based on the estimates of direct and indirect take discussed in Sections 5.1.1 and 5.1.2, respectively, the total take authorization for the Project would be 140 bats (129 direct and 11 indirect) under the HCP Amendment. This take amount consists of the 21 adult bats currently authorized under the approved ITP/ITL[5], and the additional authorized take of 119 bats requested through this HCP Amendment (Table 5-2). This requested take is based on several conservative assumptions such as the effectiveness of minimization measures; thus, the actual take that could occur may be lower than what is being requested. The assumptions or uncertainties that inform the conservative take request include the following:

- USFWS and DOFAW have recommended the 80 percent credible level be used when interpreting the results of the fatality data when using the EoA model which often inflates the fatality estimate.
- The prediction of future years of take relies on past data and incorporates uncertainty for future years which inflates the take estimate.
- The effectiveness of the minimization measures is uncertain; therefore, Auwahi Wind has chosen a conservative stance in predicting that the LWSC program will be 30 percent effective in reducing the overall number of fatalities. The best available information suggests that actual effectiveness may range between 59 percent and 76 percent, based on studies performed on the mainland.
- The take will occur slowly over time, as the highest take rate predicted in the HCP Amendment is 7 bats per year. This provides the opportunity for additional advancements in the development of new minimization measures as outlined in Section 7.4.

These factors combine to maximize the likelihood that the total take request will not be exceeded over the remaining permit term and the actual take will likely be less than the proposed amended take limit. Nonetheless, Auwahi Wind is committed to mitigate for the take requested.

The calculation of take for compliance with authorized take limits established under the ITP/ITL will use methods described in the long-term post-construction monitoring plan (Appendix E). To provide confidence that mitigation will precede or be concurrent with take, clear triggers and timing for the initiation of planning and implementation of mitigation in subsequent tiers are detailed in Section 6.2.

5.1.3.1 Potential for Population-Level Impacts

The potential Project impacts on the Hawaiian hoary bat can be assessed in relation to several of the bats' life history parameters including distribution, population size and resilience. As discussed in

[5] Per agreement with USFWS and DOFAW and biological assumptions presented in the approved HCP, 19 adults and 8 young permitted under the approved HCP were converted to 21 bats based on an assumed survival rate of juveniles to adulthood of 0.3 (Email correspondence with USFWS on April 28, 2015).

Section 3.8.1, the bat has a broad distribution across Maui that suggests the Project would only impact a small subset of the larger population on Maui. Since these bats have been documented to fly up to 7 miles in a night, the area of Maui within flight distance of the Project is approximately 11.7 percent of the island. Because the Hawaiian hoary bat has been shown to have strong fidelity to their respective roost trees (Bonaccorso 2010), this suggests that the scope of impacts would be limited. It would be improbable for all bats on Maui to traverse the Project area, and of those that do, not all would be impacted.

Additionally, the Project impacts on the Hawaiian hoary bat can also be analyzed in relation to the species' population size and resilience. The maximum estimated Project take is 6.45 bats per year over the life of the Project; but given the additional minimization measures outlined in Section 4.2.7, the total take is likely to be less than the maximum. The Maui population is estimated to be between 1400 and 5200 individuals (see Section 3.8.1), with maximum Project impact estimated to fall at 0.5 percent (or less) per year if considering the low end of the population estimate. Therefore, multiple layers of conservatism in favor of the species are built into these estimates (e.g., proportion of the island utilized by the bat, percent of land occupied, and fatality estimation), and given the low proportion of the estimated population impacted, it would be unlikely for the Project to have a significant negative impact on the Hawaiian hoary bat population of Maui.

While the impacts to the Maui population are likely to be low, the impacts of mitigation will provide a net benefit to the species. Auwahi Wind's land-based mitigation at Pu'u Makua has achieved its interim success criteria, and should continue to provide a benefit to the Hawaiian hoary bat (Auwahi Wind 2017). In addition, biological research being conducted for mitigation under Tiers 2 – 3 will contribute to filling in knowledge gaps that will lead to more effective on-the-ground management activities for the species. Additional mitigation for all Project-related take will be implemented on Maui (Sections 6.2.4 and 6.2.5) and will contribute to the species' recovery. The mitigation for Tier 4 will improve foraging habitat equivalent to 86 CUAs, exceeding the take request for Tier 4 (60 bats). Beyond the CUA analysis, bats have been shown to have overlapping foraging ranges and many more bats may benefit from the mitigation conducted than what is described in Section 6.2.4. Additionally, the habitat will last for multiple generations and outlast the permit term, and thereby providing further benefit for the species.

Notably absent from the life history traits and ecology of the Hawaiian hoary bat are factors associated with a declining population. Such factors may include:

- Low fecundity, such that the population of young does not replace adults lost to mortality[6];
- Significant loss of suitable habitat;
- Habitat specialization;

[6] The assessment of fecundity is based on the USFWS Recovery Plan and agency guidance on the calculation of indirect take (USFWS 1998 and USFWS and DOFAW 2016).

- Emigration, which is thought to be rare for Hawaiian hoary bats;
- Disease, which has not been documented in Hawaiian hoary bats; and
- Loss of food availability, which is unlikely for a prey generalist.

The Hawaiian hoary bat also has no known predators on Maui (Speakman 1995). A meta-analysis of risk factors identified large body size and limited geographic range or habitat specialization as being the strongest predictors of extinction risk (Chichorro et al. 2018). Small body size was noted to be a proxy for high fecundity and other life history traits, which are associated with a decrease in risk of extinction. Although the Hawaiian hoary bat is limited to occurrence in the Hawaiian Islands, "the mobility offered by flight renders virtually all the island from coastal embayments (Tomich 1986 and authors' personal observations) to the upper slopes of the highest mountains of Hawai`i accessible to foraging opportunities for Hawaiian hoary bats." (Gorresen et al. 2013). Data from the NOAA Coastal Change Analysis Program (CCAP) suggests the available habitat for Hawaiian hoary bat has not had a rapid decline and is unlikely to change substantially in the foreseeable future. CCAP data for Maui indicates a net increase in impervious surface of only 0.38 percent (to 3.45 percent in 2011), and a loss of forest cover of only 0.21 percent (to 32.2 percent in 2011) from 2005 to 2011, suggesting no substantial change to the available habitat over the period. This trend is an indication that the carrying capacity of the island is unlikely to undergo a rapid change due to development. The high fecundity, ability to utilize varied and spatially distributed resources, and documented distribution of the Hawaiian hoary bat suggest it is at low risk of extinction.

Recent genetic evidence suggests there have been significant inter-island dispersal events (Russell et al. 2015), but no conclusion was reached. The populations of individual islands are generally considered distinct (Baird et al. 2017). If the population of Hawaiian hoary bats on Maui is distinct, this suggests that impacts on Maui are unlikely to impact the population of other islands.

The best available information indicates that the Maui Hawaiian hoary bat population is widespread and abundant. No published or reported information suggests that either the Maui or statewide population is decreasing. Based on the best scientific data currently available, the Project is unlikely to cause adverse impacts to the species' overall population or recovery potential.

5.1.3.2 Cumulative Effects Associated with the HCP Amendment

Cumulative impacts relate to the impacts of the increased take associated with the HCP Amendment when considered in the context of past, present, and reasonably anticipated future actions that will also have an impact on the Hawaiian hoary bat population statewide and on Maui. On Maui, past development and other land use changes have resulted in the presumed loss of bat roosting and foraging habitat through the conversion of forest to agriculture and other uses (USFWS 1998). Resort or recreational developments, farming, road construction, pesticide use, and wildfires are expected to persist into the future, and have the potential to result in habitat loss or alteration, either directly or through the introduction or spread of invasive plant and insect species. Other direct impacts to bats associated with these activities may occur through collisions with structures, such as barbed wire fences, wind turbines, and communications towers, or disturbance at roost sites. These activities may also indirectly affect bats through the displacement or reduction in the number of prey resources. The cumulative impacts assessment considers several parameters including 1) take permitted on Maui, 2) take permitted on other islands, 3) potential future projects, and conservation measures such as protected lands, mitigation, and research as described below.

In addition to the Hawaiian hoary bat take authorized under the approved HCP, the only other authorized take of the Hawaiian hoary bat on Maui is from two other industrial-scale wind farms operating with approved HCPs. The Kaheawa Wind Phase I Project (20 GE 1.5-MW wind turbines) and Kaheawa Wind Phase II Project (14 GE 1.5-MW wind turbines) are located on west Maui and have authorized take levels of 50 bats and 11 bats over 20-year permit terms, respectively (KWP LLC 2006, SWCA 2011). Due to higher than anticipated incidental take levels of bats, Kaheawa Wind Phase II is in the process of amending its HCP (ESRC 2015), and has requested additional take of 27 bats. The take for all existing Maui projects is estimated at 11.4 bats per year. Based on the population estimate provided above for Maui, cumulative impacts are 1 percent (or less) of the population per year. The cumulative impact of all current Maui wind projects is not expected to have a significant impact on the population of Hawaiian hoary bats on the island, even without consideration of the associated mitigation activities of these projects.

The activities that directly impact bats on Maui (identified above), also occur on O'ahu and Hawai'i Island. The direct impacts from other authorized or proposed actions that could take bats include the following:

- Authorized take approved for two existing wind projects on O'ahu (Kawailoa is seeking an amendment to increase the amount of authorized Hawaiian hoary bat take);
- Requested take for one proposed wind project on O'ahu; and
- Requested take for two existing wind projects and one restoration project on Hawai'i Island.

Take authorization for these wind farms is contingent upon approved mitigation, which is expected to fully offset these projects' take or mitigate to the maximum extent practicable. However, movement of bats between islands is anticipated to be rare; therefore, the Project would only be expected to contribute to any cumulative impacts to the population on Maui alone.

Table 5-3. Current and Requested Take Authorizations for the Hawaiian Hoary Bat through Habitat Conservation Plans Associated with Wind Farms and Other Development in Hawai'i

Applicant	Permit Duration	Megawatts	Location	Current Take Authorization[1]	Take Request for Future HCP or HCP Amendment[1,2]
Kahuku Wind Power[3]	2010 – 2030	30	Kahuku, O'ahu	32 bats	NA
Kaheawa Wind Power I	2006 – 2026	30	Maalaea, Maui	50 bats	NA
Kaheawa Wind Power II	2012 – 2032	21	Maalaea, Maui	11 bats	38 bats
Kawailoa Wind Power	2012 – 2032	69	Kawailoa, O'ahu	60 bats	222 bats
U.S. Army Kahuku Training Area Single Wind Turbine[3]	2010 – 2030	NA	Kahuku, O'ahu	2 adults, 2 juveniles bats	NA
Auwahi Wind	2012 – 2037	24	Ulupalakua Ranch, Maui	21 bats	140 bats
Na Pua Makani Wind Farm	2019-2040	25	Kahuku, O'ahu	51 bats	NA
Pakini Nui Wind Farm	Draft requested (20 years)	21	Hawai'i Island	NA	26 bats
Lalamilo Wind Farm	Draft requested (20 years)	3.3	Hawai'i Island	NA	6 bats
Pelekane Bay Watershed Restoration Project[3]	2010 – 2030	NA	Hawai'i Island	16 bats	NA

1. Total take authorization includes adult and juvenile bats; number of adult equivalents provided by D. Sether, USFWS, 2018.
2. Total includes previous authorized take.
3. Take authorized under ESA Section 7 Biological Opinion.

These take rates are likely to decline as the risk factors associated with Hawaiian hoary bat fatalities are researched, and minimization measures are improved for wind farms. Additionally, several companies are working to develop effective bat deterrents and conducting research into ultrasonic and ultraviolet deterrents to reduce the risk of bat fatalities at wind farms. The future installation of bat deterrents at wind farms in Hawai'i is anticipated, and would further reduce the risk of cumulative impacts to the bat if implemented for operational and future projects.

The likelihood of new development must also be considered in the impacts to species. The Hawaiian Electric Companies (HECO) issued a renewable energy request for proposals seeking to develop an additional 60 MW of renewable energy on Maui (HECO 2018) in Phase 1 and issued a draft proposal for Phase 2. No new wind energy projects were identified for Maui in 2018 and it is not known what type of projects will be selected for Phase 2. It is not known if HECO will initiate new requests in the next 5 years, but the start of operations of a new project in the next 5 years as part of a new RFP is unlikely, given that no projects were identified in 2018. The Hawai'i Clean Energy Initiative (HRS 196-10.5) and Renewable Portfolio Standards (HRS 269-92) specifies that the State of Hawai'i will establish a renewable portfolio standard of 100 percent of net electricity sales from renewable sources by 2045. The new wind projects would be anticipated to be proposed in the future, but the timing, approval, construction, and operation of such projects is uncertain, and therefore it is not possible to incorporate such information into the analysis of cumulative impacts.

Additionally, Hawaiian hoary bats have been documented on Kaua'i, Molokai, and Lana'i. These three islands have no wind energy projects, and the populations would not be expected to be impacted by any of the existing wind projects or likely any future projects. As previously stated, the populations of individual islands are considered distinct. The existence of the species on these islands is a further assurance of the persistence of the Hawaiian hoary bat.

Another documented mortality source for Hawaiian hoary bats involves the bats becoming snagged on barbed wire; this is a concern statewide, with rates on Maui expected to be similar to the statewide range of 0.0-0.8 Hawaiian hoary bats per 62 miles of barbed wire (Zimpfer and Bonaccorso 2010). Observed fatalities are uncommon, because most fences are not checked regularly, and bats caught on these fences may quickly be taken by predators or scavengers. Based on the low estimates of mortality related to bat impalement on barbed-wire fences, the impact of the HCP Amendment in combination with this impact is not expected to result in significant cumulative impacts to the species on Maui, or statewide. Other anthropogenic sources of take potentially include: timber harvesting, drowning, pesticides, predation or competition from introduced species, and climate change. The scale of the impacts from the identified activities is not monitored, but it is thought to be minimal (USFWS personal communication April 2019).

Another consideration for impact assessment is the abundance of forested and/or protected lands on Maui and statewide that would serve as habitat for the Hawaiian hoary bat. Conservation lands across the state protect habitat likely to be used by Hawaiian hoary bats. Approximately 205,500 acres of conservation lands occur on Maui; over 2 million acres of conservation lands occur statewide. In addition to the 150,000 acres of forest on Maui, an estimated 1.5 million acres of forest habitat occur across the state. These lands would be expected to provide available habitat that would enable the Hawaiian hoary bat to continue to survive and reproduce, despite anthropogenic losses.

Approved and pending authorized levels of bat take would be expected to be fully mitigated, with the exception of the U.S. Army Kahuku Training Area and Pelekane Bay Watershed Restoration Project, for which mitigation is a recommendation under the USFWS's ESA Section 7 Biological Opinion (USFWS 2003), but not required. The approved and pending HCPs include a combination of habitat restoration and research (see Section 6.0 for Project-specific Hawaiian hoary bat mitigation under the HCP Amendment). Habitat restoration is intended to create or improve the quality of bat foraging and roosting habitat; the Hawaiian hoary bat recovery plan (USFWS 1998) identifies the loss and degradation of habitat as a major factor impacting the species. Restoration actions incorporated into the approved and pending HCPs include installation of ungulate fencing, the removal of non-native ungulates and invasive plant species, and/or planting of native trees and shrubs. Over time, these actions are anticipated to create high quality, sustainable, native foraging and roosting habitat, benefiting bats beyond the ITP/ITL terms, and thereby resulting in a net benefit to the species.

The research component of the mitigation is critical to filling data gaps about the species, and was identified as a priority recovery action in the Hawaiian hoary bat recovery plan (USFWS 1998). Research projects approved by USFWS and DOFAW are designed to gain an understanding of basic life history parameters and develop effective mitigation measures for the species (DOFAW 2015), which will ultimately guide future management and recovery efforts.

The impacts of the Project and the cumulative impacts of wind energy on Maui are unlikely to have a significant negative impact on the Hawaiian hoary bat population. The process of estimating take for the HCP Amendment using EoA and PCMM data provides a high degree of certainty that actual take will be less than predicted take. Current and pending actions of HCPs are expected to fully mitigate for their take, and provide a net benefit as required by Hawaii law, thus the cumulative impact to the Hawaiian hoary bat associated with the increased take from the HCP Amendment is expected to be none to minimal. Pursuant to USFWS and DLNR ITP/ITL issuance criteria, the provisions described in the HCP amendment, including the avoidance and minimization measures, mitigation, and adaptive management program, identify how any bat take will not jeopardize the survival and recovery of the species. The mitigation described in Section 6.2.4 and 6.2.5 increases the chances of survival and the likelihood of recovery for the listed species by providing a net benefit to the species.

5.1.4 Tiers of Take

To address the uncertainty associated with the effectiveness of the proposed LWSC program in reducing direct bat take (Section 4.2.7) and the conservative assumptions used in estimating future take as described above, Auwahi Wind divided the new requested take into three additional tiers (Tiers 4 – 6; Table 5-4). The additional tiers are based on varying percentages of reduction in bat take as a result of effectiveness of LWSC, ranging from 30 to 70 percent.

The three proposed tiers of take are representative of the uncertainty associated with the degree of effectiveness minimization and adaptive management measures will have in terms of reducing the take of Hawaiian hoary bats. The best available public information (Appendix G) suggests LWSC minimization measures may reduce bat take up to 76 percent relative to the current estimated take. Auwahi Wind assumes a more conservative approach, because the effectiveness documented in other studies is subject to site-specific conditions and may vary with different sites. Auwahi Wind based the new tiers on three take rates to represent the uncertainty of the effectiveness of LWSC: 70 percent reduction from current take rates (Tier 4), 50 percent reduction from current take rates (Tier 5), and 30 percent reduction from current take rates (Tier 6). For example, reducing the take rate by only 30 percent would equate to an average take of 7.00 bats per year (140 bats/20 years) over the life of the Project and a higher overall take estimate. However, if the take rate is reduced by 70 percent relative to past monitored years, the take rate over the life of the Project would be expected to be an average of 4.05 or fewer bats per year (81 bats/20 years). These projections of take form the biological basis for Tiers 4 – 6.

For the potential future scenarios, the EoA analysis utilized data through December 31, 2017, and an average detection probability (ghat) value from canine searching, as well as 2017 study parameter data, to estimate take in years 2018 – 2032. The values of estimated take associated with each percentage of reduction in take rate, were allotted to each tier based on USFWS recommendations for tiered take at wind facilities (USFWS 2016b). Each tier represents the cumulative total take (direct and indirect) requested (i.e., take is not additive among tiers).

This tier framework helps address variation and uncertainty due to 1) the inter-annual variability in observed take, 2) the effect of small sample sizes on take predictions, 3) the potential for a stochastic event in 2016 to have disproportionately influenced predictions of future take, and 4) the high degree of conservatism used in the estimation process. The tier framework also allows for new information, to be incorporated into future tier mitigation projects (see Section 3.8.1 and Section 7.4.1.2). Triggering of mitigation for the associated tiers of take is discussed in Section 6.2.5.

Table 5-4. Tiers of Take for the Hawaiian Hoary Bat

Tier[1]	Cumulative Estimated Take	Take in Tier	Basis for Take within Designated Tier[2]
1	5	5	Estimate developed in approved HCP.
2	11	6	Estimate developed in approved HCP.
3	21	10	Estimate developed in approved HCP.
4 (New)	81	60	Assumed reduction in take rate of 70% in years 2018-2032 (relative to the current take rate).
5 (New)	115	34	Assumed reduction in take rate of 50% in years 2018-2032 (relative to the current take rate).
6 (New)	140	25	Assumed reduction in take rate of 30% in years 2018-2032 (relative to the current take rate). Represents baseline condition for estimated take request.

1. Each tier represents the total take requested (i.e., take is not additive across tiers).

2. The scenarios described are representative of the conditions that could result in take being limited to each specific tier. Many factors may affect estimates, and none of these can be known in advance. All scenarios utilize EoA analysis utilizing data through December 31, 2017, and overall detection probability derived from canine searching.

5.2 Hawaiian Petrel

This section requires no edits for the HCP Amendment.

5.3 Nene

This section requires no edits for the HCP Amendment.

5.4 Blackburn's Sphinx Moth

This section requires no edits for the HCP Amendment.

6.0 COMPENSATORY MITIGATION FOR POTENTIAL IMPACTS

This section requires no edits for the HCP Amendment.

6.1 MITIGATION LOCATIONS

This section requires no edits for the HCP Amendment.

6.2 HAWAIIAN HOARY BAT

Mitigation for additional tiers of take under the HCP Amendment was informed by the recovery priorities described in the Hawaiian Hoary Bat Recovery Plan (USFWS 1998), the best available information on the Hawaiian hoary bat and other bat species, and supplemented by the April 2015 ESRC workshop, the resulting ESRC Bat Guidance (DOFAW 2015) for projects that have the potential to positively impact the species. The results of this workshop and subsequent ESRC Bat Guidance included:

- Recognition of the need for more research to understand the Hawaiian hoary bat life history and limiting factors;
- Identification of research priorities that would help develop effective mitigation strategies; and,
- Recognition of the need to closely monitor a variety of habitat restoration projects to measure their benefits to the Hawaiian hoary bat.

As described in Section 3.8.1.1, several research projects were approved as mitigation for wind HCPs based on research priorities and costs identified in the ESRC Bat Guidance (DOFAW 2015). The ESRC Bat Guidance recommends mitigation for the Hawaiian hoary bat be valued at $50,000 per bat (DOFAW 2015); however, USFWS provided revised verbal guidance in May 2018 to clarify that the $50,000 per bat rate only applies to research approved as mitigation for bats. Furthermore, USFWS and DOFAW current guidance (USFWS and DOFAW meetings May 1, 2018) is that land-based mitigation projects are preferred, and research is considered to be a lower priority until the results of the current research projects are known. Land-based mitigation efforts should have clear biological goals and objectives, and thus, measures of success that tie directly or by proxy, to increases in reproductive success, or increases in rates of use by the Hawaiian hoary bat. No additional research-based mitigation is proposed for Tiers 4-6 under this HCP amendment.

6.2.1 Tier 1 Mitigation

Tier 1 mitigation for the Hawaiian hoary bat is on-going and has met Interim Success Criteria; it consists of Hawaiian hoary bat habitat restoration measures and on-site acoustic monitoring. The Puʻu Makua parcel of the Waihou Mitigation Area was placed into a conservation easement held by the Hawaiian Islands Land Trust (HILT) on December 18, 2012. Restoration measures for approximately 130 acres of pastureland in the parcel were initiated following issuance of the

ITP/ITL. In September 2013, an ungulate-proof fence surrounding the parcel was completed, and all ungulates were removed from the parcel by January 2014. Following initial baseline vegetation monitoring of the parcel in March 2014, biannual sweeps to remove primary invasive plant species were initiated. A second baseline survey was conducted in February 2015, and native tree out-planting began in spring 2015. Thirty-nine acres of native trees were out-planted in 2015 (Figure 6-1). Native reforestation, vegetation monitoring, and invasive species removal efforts are ongoing. In addition, acoustic monitoring of bats was conducted at the Project from July 2013 through December 2015 using two ground-based acoustic monitoring units as required.

Auwahi Wind has exceeded the Interim Success Criteria established for Year 3 (FY 2018). The target for non-native plant cover (excluding kikuyu grass, *Pennisetum clandestinum*) for Year 3 was set at less than 75 percent; measured non-native plant cover in FY 2018 was 4.5 percent. The target for native species outplantings survival for Year 3 was set at 75 percent; actual survival was 87 percent survival across plots for Year 2, and ongoing outplantings to replace lost plants (May 2017–June 2018) ensures that the interim and long-term mitigation targets are reached.

Figure 6-1. Aerial Image of Most Outplantings (image taken using a DJI inspire drone and shot in June 2018)

6.2.2 Tier 2 and Tier 3 Mitigation

Tier 2 and Tier 3 mitigation is also on-going and being successfully implemented. The mitigation includes funding of Hawaiian hoary bat research that contributes to knowledge of the species on Maui. Beginning in 2013, Tetra Tech, Inc. and Dr. Frank Bonaccorso (USGS) worked together to develop a phased research plan to use acoustic monitoring and radio telemetry methods to:

- Evaluate home range size and habitat composition;

- Evaluate seasonal patterns of bat activity at the Waihou Mitigation Area; and
- Examine prey abundance and diet composition by bats in the Waihou Mitigation Area.

The Tier 2 research plan was approved by USFWS and DOFAW in February 2014. Acoustic monitoring efforts were initiated at the Waihou Mitigation Area in March 2015. Subsequently, the Tier 3 research plan expanded the sampling and scope of the approved Tier 2 research plan. The final Tier 2 – 3 research plan was approved by USFWS and DOFAW in May 2016. This research plan includes acoustic monitoring (2015 – 2018), seasonal radio telemetry (2016 – 2017) with two additional phases of radio-telemetry to be completed and timed based on results from on-going acoustic monitoring efforts, an insect prey base study (2016), and a food habit assessment (2016 – 2017). The radio-telemetry component of this project was replaced in 2017 with additional monitoring (outlined below) through adaptive management in consultation with USFWS and DOFAW due to broadcast tower interference with radio-telemetry signals. Adaptive management measures to the research component include:

1) Increase in the staff effort devoted to nights of mist-netting at Pu'u Makua and outlying areas within the Ranch, to capture bats for genetic sampling and fecal collection;
2) Add a second season of insect prey base sampling at the Waihou Mitigation Area and mist net sites, where only a single season was previously planned/budgeted;
3) Increase the number of insect prey species (up to 150 insect samples) that will be bar-coded for a larger library to match with insect fecal pellets in a dietary study;[7] and
4) Add other potential items to the scope of work if field time and funds allow:
    a. Adding one acoustic meter near the location called Duck Ponds; and
    b. Adding insect prey base sampling at the Project.

These efforts are on-going with results to be provided in HCP annual reports.

While no capture rates are recorded prior to mitigation and as such no baseline is available for comparison, the initial results of this work indicate a higher use rate than predicted by mitigation targets for Tier 1. The USGS tagged 11 Hawaiian hoary bats in the Waihou Area while conducting monitoring for Auwahi Wind under Tier 2-3 mitigation.

6.2.3 Tiers 4 – 6

The mitigation described in this HCP Amendment for Tiers 4 – 6 will offset the requested bat take. A detailed outline for Tier 4 Mitigation is provided in Section 6.2.4, while the mitigation program for Tiers 5 and 6 is described in Section 6.2.5. Adaptive management for Tiers 5 and 6 mitigation will

[7] This effort is distinct from the USGS proposal currently accepted by the ESRC, although the analysis will be in parallel.

provide an opportunity for Auwahi Wind to incorporate the best available science and results from ongoing research described in Section 3.8.1.1 and the results of Tier 2-3 mitigation.

In addition to the mitigation provided for Tiers 4 - 6, Auwahi Wind will conduct a single-year occupancy study of the Hawaiian hoary bat on Leeward Haleakalā. The study area spans from Ahihi-Kinau Natural Area Reserve to Kaupō gap, and from the summit of Haleakalā to the coast. The study methods are consistent with, and comparable to, the multi-year occupancy study occurring on O'ahu developed in collaboration with the ESRC Bat Task Force. Based on prior studies (Todd et al. 2016, Starcevich et al. 2019), a sample of 20 detectors will be installed. The study begins in July 2019 and continues for 1 year. Single-year occupancy models (MacKenzie et al. 2019) will be used to estimate occupancy rates and detection probabilities, and covariate relationships where possible (MacKenzie et al. 2019). Although Auwahi Wind's mitigation is consistent with the ESRC Bat Guidance recommendations as described below, this occupancy study provides a significant additional research benefit.

6.2.4 Tier 4 Mitigation

The objective of the Tier 4 Mitigation is to protect, manage, and enhance habitat that is suitable for bat foraging and roosting through the addition of features necessary for those stages of the Hawaiian hoary bat life cycle. Auwahi Wind has leveraged results of the research and restoration efforts conducted in Tiers 1 – 3, data from other applicable studies, and USFWS and DOFAW mitigation guidance, to identify appropriate Tier 4 mitigation that will offset the incidental take of at least 60 bats.

Auwahi Wind's Hawaiian hoary bat Tier 4 Mitigation will be located on 1,752 acres of Leeward Haleakalā, on Ranch land (Mitigation Area; Figure 6-2). The proposed Tier 4 Mitigation Area is of relatively high elevation and would be expected to provide primarily foraging and roosting habitat since pupping generally occurs at lower elevations (C. Pinzari, personal communication August 1, 2018). The mitigation actions included in the Tier 4 Mitigation will protect existing bat habitat as well as enhance bat habitat through the addition of resource features to increase bat foraging and roosting in the near and long term and augment the connectivity between nearby State Forest Reserves and other conservation areas that currently provide bat habitat. Auwahi Wind anticipates that the mitigation project will more than fully offset the incidental take of 60 Hawaiian hoary bats and provide a net benefit based on the following:

- The median CUA for one Hawaiian hoary bat is approximately 20.3 acres (Bonaccorso 2015); the 1,752 acres will provide 29.2 acres for each of the 60 bats covered in Tier 4;
- The size of the CUA of Hawaiian hoary bats varies based on the specific habitat types and features located within a given area;
- Enhancement of bat habitat through the addition of key resource features can reduce the size of an area required for Hawaiian hoary bats to meet foraging needs; and

- Specific habitat enhancements documented in the available literature to be associated with higher bat use rates will be selected and implemented to improve the mosaic of habitat structure.

The following sections provide an overview of the proposed Tier 4 Mitigation by describing 1) the Mitigation Area, 2) the management actions that will be implemented to benefit bats, 3) the estimation of take offset/net benefit, 4) the measures of success to achieve the take offset/net benefit, 5) a monitoring plan, 6) an adaptive management strategy, and 7) a timeline for implementation.

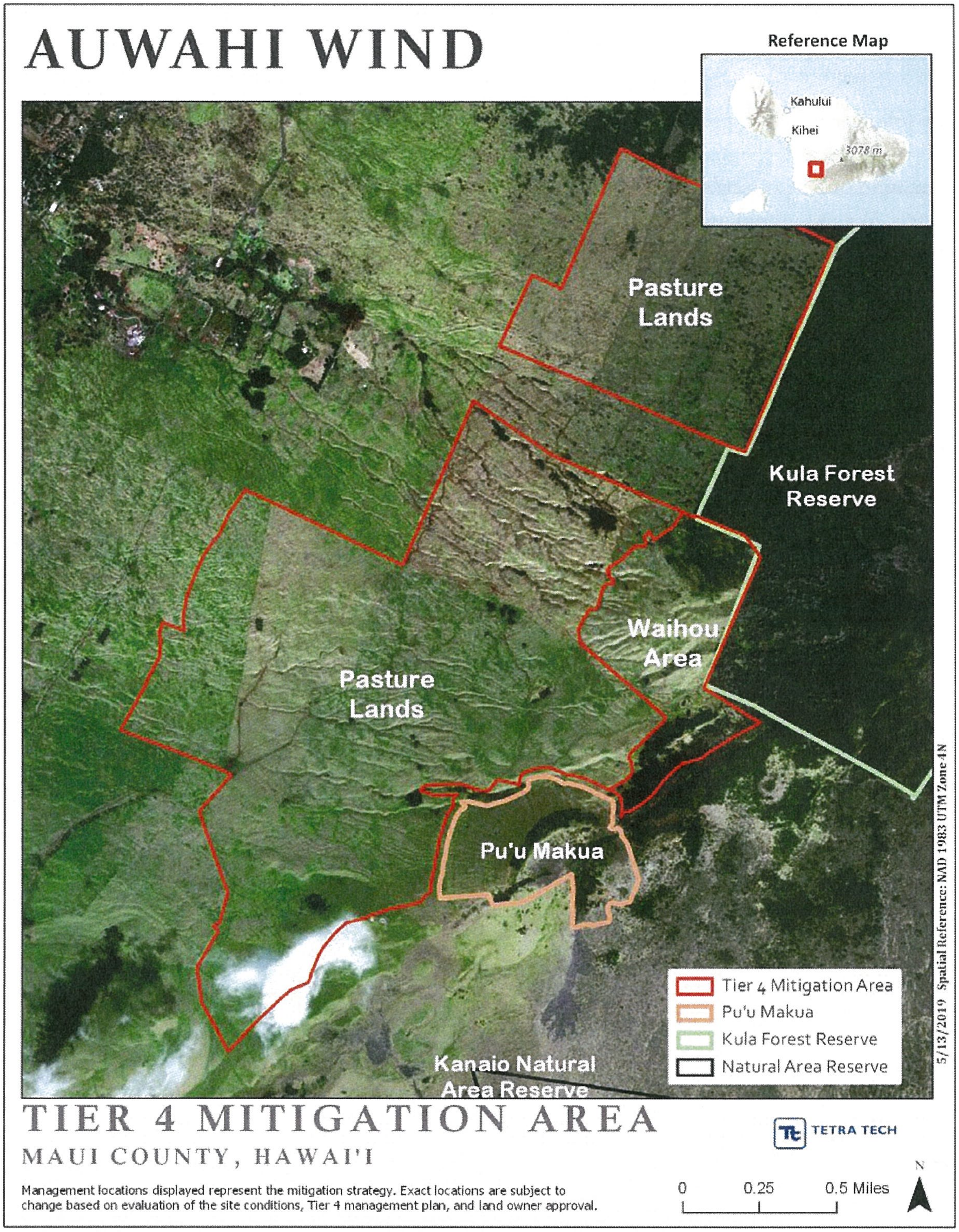


Figure 6-2. Site Location, Aerial Imagery, and Proposed Layout of Mitigation Parcels within the Mitigation Area

6.2.4.1 Mitigation Area

Habitat Description

Auwahi Wind has identified the 1,752 acre Mitigation Area as being a priority parcel for protection and management actions for the Hawaiian hoary bat. The Mitigation Area includes the Waihou Area, the Duck Ponds, Cornwell, and Kaumea Loko parcels identified in the Auwahi Wind HCP as potential mitigation areas. These parcels within the Waihou Area were identified in the approved HCP for future possible mitigation tiers, but were not used for the approved HCP. Bats have been documented within and adjacent to the Mitigation Area. USGS mist netting has resulted in the tagging of 11 individual Hawaiian hoary bats at the Duck Ponds, and USGS has documented bat use of the forest patches within the Waihou Area (Auwahi Wind 2017). Additionally, USGS researchers have recorded bat calls at the nearby Pu'u Makua Mitigation Site (Figure 6-2; Auwahi Wind 2017). Results from USGS research indicate that bats are present year-round at Pu'u Makua. The detectability of Hawaiian hoary bats at Pu'u Makua has varied but fluctuates around the average detectability of 0.38. Detectability represents the nightly frequency of bat presence on a scale of 0 to 1, with 0 describing no bat activity and 1 representing acoustic activity every night within a survey period.

The elevation of the Mitigation Area ranges between 3,300 and 5,500 feet asl, and the land use is commercial cattle ranching. Recent research suggests that resource availability at high elevation sites may be an important limiting factor for Hawaiian hoary bats in the non-breeding season (Gorresen et al. 2018). Under the proposed Tier 4 Mitigation, the property and existing pastures will continue to be used for seasonal grazing, but new management actions will be implemented to protect and enhance bat foraging and roosting habitat, as described in Section 6.2.4.2 below. Protecting and managing these lands with a conservation easement to restrict any future incompatible uses will ensure long-term benefit to the bat and enhance the connectivity to the nearby Kula State Forest Reserve, and the 120-acre Pu'u Makau Restoration Site that provide protected bat roosting habitat (Figure 6-2, Lance DeSilva, DOFAW, personal communication, 10 August 2018; Auwahi Wind 2017). Further details of the legal protections that will be included as part of Tier 4 Mitigation are included under Mitigation Actions (Section 6.2.4.2).

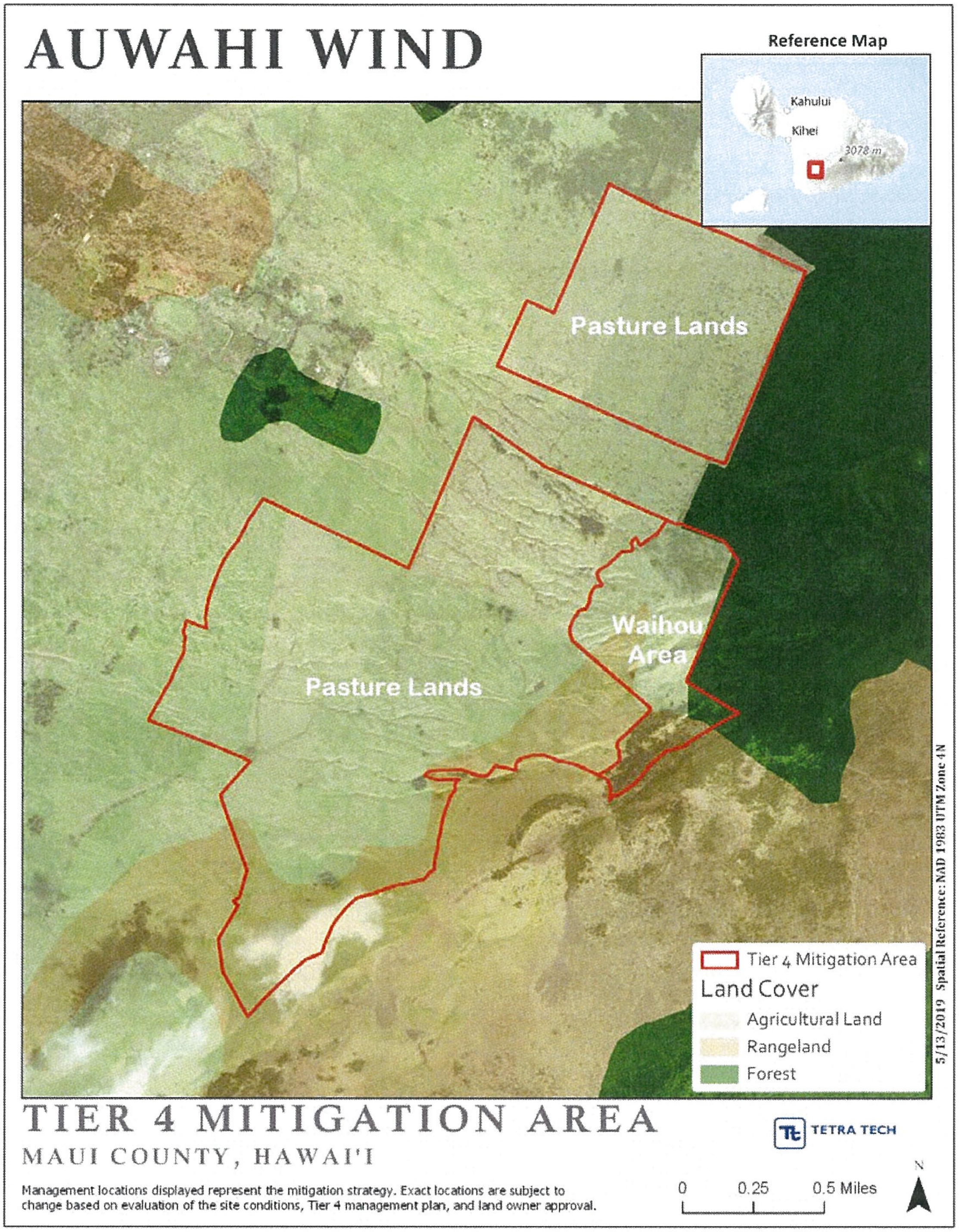
The Mitigation Area consists primarily (more than 95 percent) of sloping open grasslands, interspersed with gulches, and a few forested patches and hedgerows (Figure 6-3). The grasslands consist primarily of Kikuyu grass (*Pennisetum clandestinum*) as well as a mix of other non-native species. The existing open habitats would be expected to provide little benefit to bats except foraging near hedgerows or limited use by bats transiting the area. Although bats have been documented to traverse open areas, their foraging is associated with insect abundance (Bellwood and Fullard 1984), and insect abundance is inversely corelated with distance from woody vegetation (Lewis 1969). The distance to the nearest forest edge has similarly been found to be inversely corelated with bat activity (Downs and Sanderson 2010). The gulches on the property are primarily contained within a 150-acre parcel and have been noted by USGS to provide structure that would likely be utilized by bats. Scattered clusters of trees occur throughout the habitat and several sections of forest which connect to the Kula Forest Reserve. Bats may use these scattered trees (Auwahi Wind 2017).

Auwahi Wind has broken the management program into two units: the Waihou Area and the Pasture Lands (Figure 6-3). The Pasture Lands are 1,556 acres of primarily grasslands as described above. There is a gap in the Pasture Lands parcels which is not owned by the Ranch. The Waihou Area is 196 acres and has approximately 20 percent forest cover, 80 percent grasslands. The general habitat types are shown in the aerial imagery in Figure 6-2 and in Figure 6-4, from data by the Geographic Information Retrieval and Analysis System (GIRAS) provided on the State of Hawaii: Office of Planning website (State of Hawaii 2018).

Water is a scarce resource in Leeward Haleakala, and water resources in the Mitigation Area consist of 5 ponds, seasonally active water troughs, and dry or perennial small streams (Figure 6-5, USGS 2013). The area surrounding the existing ponds is not grazed by cattle.and are generally vegetated by non-native grasses (e.g., kikuyu grass; Figure 6-3). The ponds within the Mitigation Area are man-made and consist of an excavated depression up to 10 feet deep and range in size from 40 by 50 feet up to 60 by 120 feet. The ponds are lined with a plastic liner and back-filled, the liner is able to capture rainwater sufficient to recharge a pond within 9 months after that pond has been emptied (Ulupalakua Ranch, personal communication, October 23, 2018).

Hawaiian hoary bats have been documented to use the existing ponds in the Duck Ponds parcel (Auwahi Wind 2017). Created ponds such as those in the Duck Ponds are the only consistent sources of open water in the vicinity (Figure 6-5). Flow lines noted in the National Hydrography Dataset are normally dry and only fill when major flooding occurs. Other water sources such as cattle troughs are only active seasonally, specific to cattle use, approximately 2 to 4 months per year. Fifteen water troughs currently exist within the Mitigation Area (Figure 6-5). Figure 6-3 displays the existing habitat ponds.

Figure 6-3. Pictures of the Mitigation area (top), and one of the existing ponds within the Mitigation Area (bottom).



Source: GIRAS, State of Hawaii Office of Planning 2018

Figure 6-4. Land Cover in the Mitigation Area from Geographic Information Retrieval and Analysis

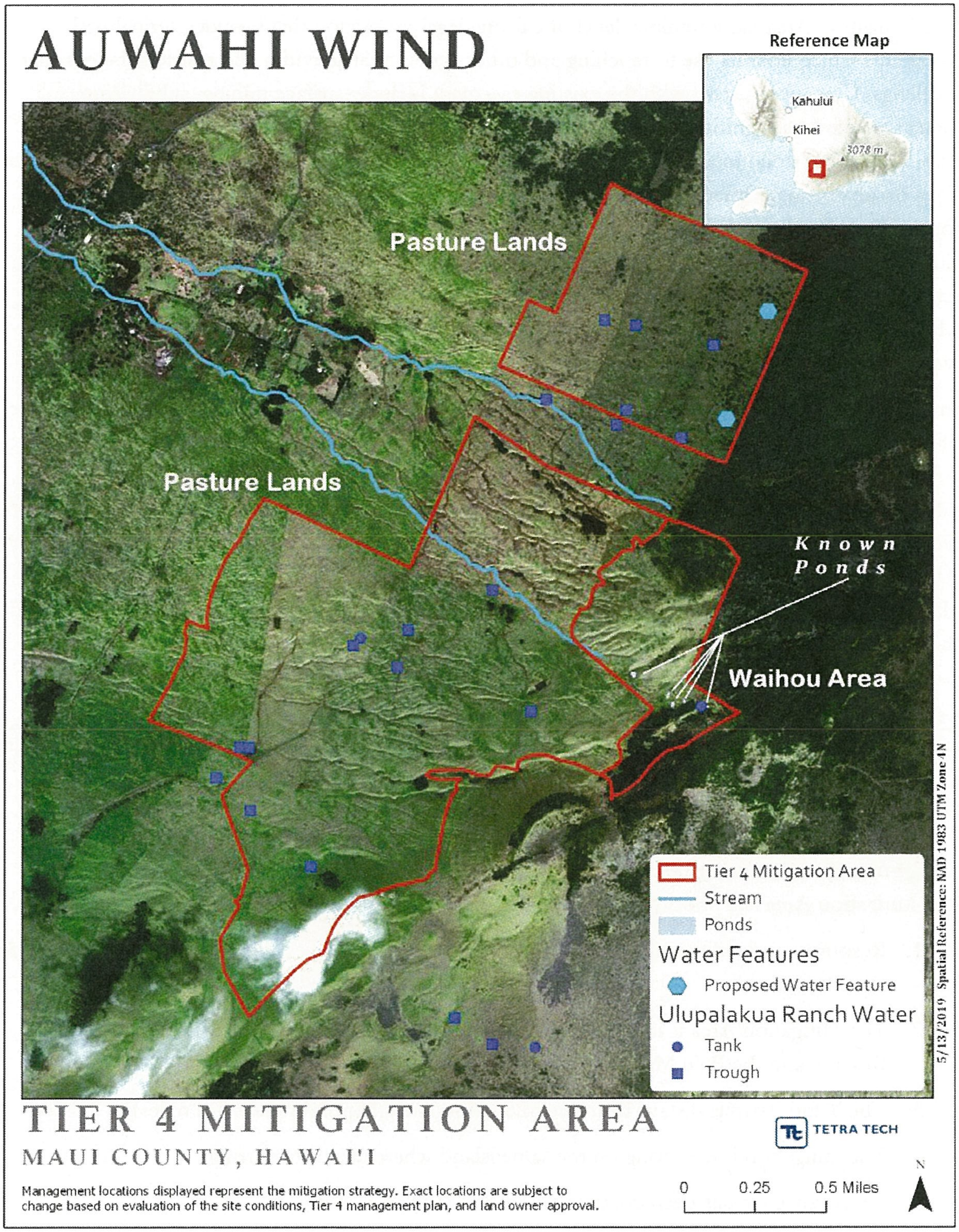


Figure 6-5. Water Resources, Known and Proposed Within the Mitigation Area

Existing Legal Protection

The Mitigation Area has a minimal level of existing legal protection that includes agricultural easements which limit its use to ranching and other agricultural activities and restricts the number of dwellings. Uses inconsistent with the existing easement include: surface mining, subdivision, industrial activities, significant alteration of the surface of the land, activities causing significant erosion or water pollution, alteration of water courses, waste disposal, or the addition of commercial signs or advertising. Other applicable restrictions do not appreciably alter the suitability of the site for the Hawaiian hoary bat and can be found recorded with the State of Hawai'i Bureau of Conveyances. Notably absent from the existing restrictions are limitations on the removal of trees; removal of existing tree cover on the Ranch lands could substantially impact existing bat habitat which occurs in scattered clusters across the Ranch. There are no restrictions on the use of insecticides or stocking ponds with insectivorous fish, which could impact Hawaiian hoary bats.

In the absence of the proposed mitigation's conservation easement, bat habitat quality, and the use of the Mitigation Area by bats, would likely remain low and could diminish in the event that currently permitted changes to land use occur. These lands are not managed for bat habitat purposes, and property features (trees, water features) which provide habitat benefits for bats are not required to be maintained. The Ranch anticipates increasing the number of cattle on their property (Ulupalakua Ranch, personal communication, August 13, 2018), and with land resources scarce in Hawaii, would likely use and manage the existing lands more intensively. Cuddihy (1984) evaluated the difference between grazed and park lands on Hawai'i Island, and showed that grazing is correlated with decreases in structural complexity and increases in cover of non-native grasses despite similarity in soils between treatment and control sites. This study found tree density increased significantly less in a grazed site than adjacent park parcels, suggesting that existing grazing in the Mitigation Area would continue to impair the long-term suitability of the site for Hawaiian hoary bat use, if not managed through the Tier 4 Mitigation.

Mitigation Site Summary

The Mitigation Area is a priority for the following reasons:

1. Resource availability at high elevation sites is suggested to be an important limiting factor for bat populations;
2. The Mitigation Area is located adjacent to existing bat roosting habitat in the Kula Forest Reserve and the Pu'u Makua Mitigation site;
3. The Wind Farm is distant from the Mitigation Area (approximately five miles);
4. The mitigation is occurring on the same island where take is occurring;
5. Bat occurrence has been documented in the Mitigation Area;
6. The Mitigation Area currently consists of low quality habitat, which will be improved through management actions, to increase bat use;

7. The Mitigation Area currently has minimal legal protections, which will be enhanced for the Hawaiian hoary bat, with a permanent conservation easement; and
8. The land owner is a USFWS conservation partner and supportive of the easement and management actions proposed.

6.2.4.2 Mitigation Actions

The mitigation actions described here draw heavily upon literature outlined in Section 3.8.1 above, guidance derived from Bat Conservation International (BCI) for the management of water features (Taylor and Tuttle 2007), and recommendations from the Joint Nature Conservation Committee[8]. The Joint Nature Conservation Committee is a statutory advisory committee for the government of the United Kingdom (Entwistle et al. 2001), which provide guidance for rangeland managers to promote bat use on rangelands. To achieve the mitigation objective of protecting and enhancing bat foraging and roosting habitat in the Mitigation Area, Auwahi Wind will 1) create forested linear landscape features (i.e., hedgerows) that can be used as foraging and night roosting substrate and travel corridors, and 2) provide suitable, consistent water resources for the bat. These added features will increase the amount of available foraging and roosting resources for Hawaiian hoary bats on Maui. Furthermore, the location of the added resources will reduce the energetic costs associated with foraging and drinking by providing suitable foraging grounds and water sources in proximity to day roosting habitat, where none previously existed. In addition to the creation of these two feature types, Auwahi Wind will also implement fire management and legal protection of the Mitigation Area. The combination of these specific mitigation actions will provide immediate, near-term, and long-term benefits to bats.

Reforestation of Hedgerows

Reforestation of fence line hedgerows is recommended to facilitate bats transiting the Mitigation Area and serve as a foraging and roosting substrate (Entwistle et al. 2001, Jantzen 2012).

The reforestation of these hedgerows will provide the Hawaiian hoary bat a patchwork of open foraging areas, edge habitat, and closed canopy which provide shelter from strong winds, night roost habitat, and available prey for foraging. Bats and dung beetles at study sites in Nicaragua were more abundant at hedgerows than in pasture lands with low tree cover (Harvey et al. 2006). Hedgerows serve as both shelter and habitat for insects with insect abundance typically greater in the lee of hedgerows. This pattern of hedgerow use applied for beetle species (*Lathridiidae*) and flies (*Scatopsidae* and *Sphaeroceridae*) while moths were more commonly found within the hedge (Lewis 1969). Hedges are one of the most important non-crop habitats on farmland and support a high biomass of arthropods (Pollard and Holland 2006).

Information on the insect species associated with reforestation of grassland on Maui is available in conjunction with reforestation efforts at the Nakula Natural Area Reserve (NAR) conducted by the

[8] The recommendations of BCI and the Joint Nature Conservation Committee are not species-specific.

Maui Forest Bird Recovery Project since 2011. Reforestation efforts in the Nakula NAR have resulted in 98 acres of reforested grasslands. The insect abundance in the Nakula NAR was evaluated in 2011 (Peck et al. 2015) in the existing koa stands to look for food species of the kiwikiu (Maui parrotbill; *Pseudonestor xanthophrys*) and Maui ʻalauahio (Maui creeper; *Paroreomyza montana*). The diet of these two forest birds includes significant portions of moth larvae and beetles, which suggests an overlap with bats in the insect species consumed (bats are not expected to feed on larvae, but rather, flying adult moths and beetles, Todd 2012). Species composition was dominated by moths with a significant portion of beetles. Total insect biomass was not significantly different than Waikamoi (which is mature native forest), suggesting the Nakula NAR prey base can support Hawaiian birds. Analysis of insects at Waihou also demonstrates that koa and a'ali'i support lepidopteran and coleopteran species (Auwahi Wind 2017). The availability of these insects would also be expected to benefit Hawaiian hoary bats by providing available insect biomass for foraging. All of these studies indicate that hedgerows of koa and a'ali'i in the Mitigation Area would be anticipated to increase the insect biomass available for foraging bats.

The continued grazing of pastures between hedgerows is anticipated to facilitate bat foraging in the Mitigation Area and expected to provide insect biomass for bat foraging. Studies recommended by C. Pinzari (Corinna Pinzari, HCSU, personal communication, 7 Aug 2018) showed that bats in Italy and the United Kingdom use cattle grazing areas as a foraging resource with bat activity increasing with herd size (Ancillotto et al. 2017, Downs and Sanderson 2010). Additionally, the distance to the nearest forest edge and nearest tree were significant covariates of bat activity and distance was negatively correlated with activity. The significance of distance to forest edge shows that the addition of hedgerows fundamentally changes a bat's ability to access foraging resources in pasture lands. The species studied above are hawking insectivorous bats, a trait common with the Hawaiian hoary bat. The habitat needs for these species is associated with grazing and this combination of habitat features is expected to enhance bat foraging, because bats utilize insects associated with cattle and cattle dung as prey (Ancillotto et al. 2017, Downs and Sanderson 2010). Moth abundance is associated with an intermediate level of grazing (Pöyry et al. 2004). Similarly, grazing can reduce the vegetation cover to promote conditions where bats could more easily capture prey (Rainho et al. 2010). In Hawai'i, a decrease in Hawaiian hoary bat activity was linked to the elimination of ungulates in the Kahikinui Forest Reserve on Maui (Todd et al. 2016). The consumption of dung beetles has been noted in the diet of Hawaiian hoary bats (Whitaker and Tomich 1983). These studies suggest that grazing is a compatible land use with the actions taken to benefit the Hawaiian hoary bat.

Therefore, Auwahi Wind will reforest the hedgerows within the 1,556 acres of Pasture Lands Mitigation Area (excludes the Waihou Area). The Pasture Lands will be reforested to a minimum density of approximately 20 percent or 311 acres of forest cover (Figure 6-6), which corresponds to the first statistically significant peak in mainland hoary bat utilization (Jantzen 2012). For Hawaiian hoary bats, canopy cover has been documented to be negatively related to bat detection (Gorresen et al. 2015) supporting the findings from mainland hoary bats, which suggest open areas for foraging in proximity to trees is important.

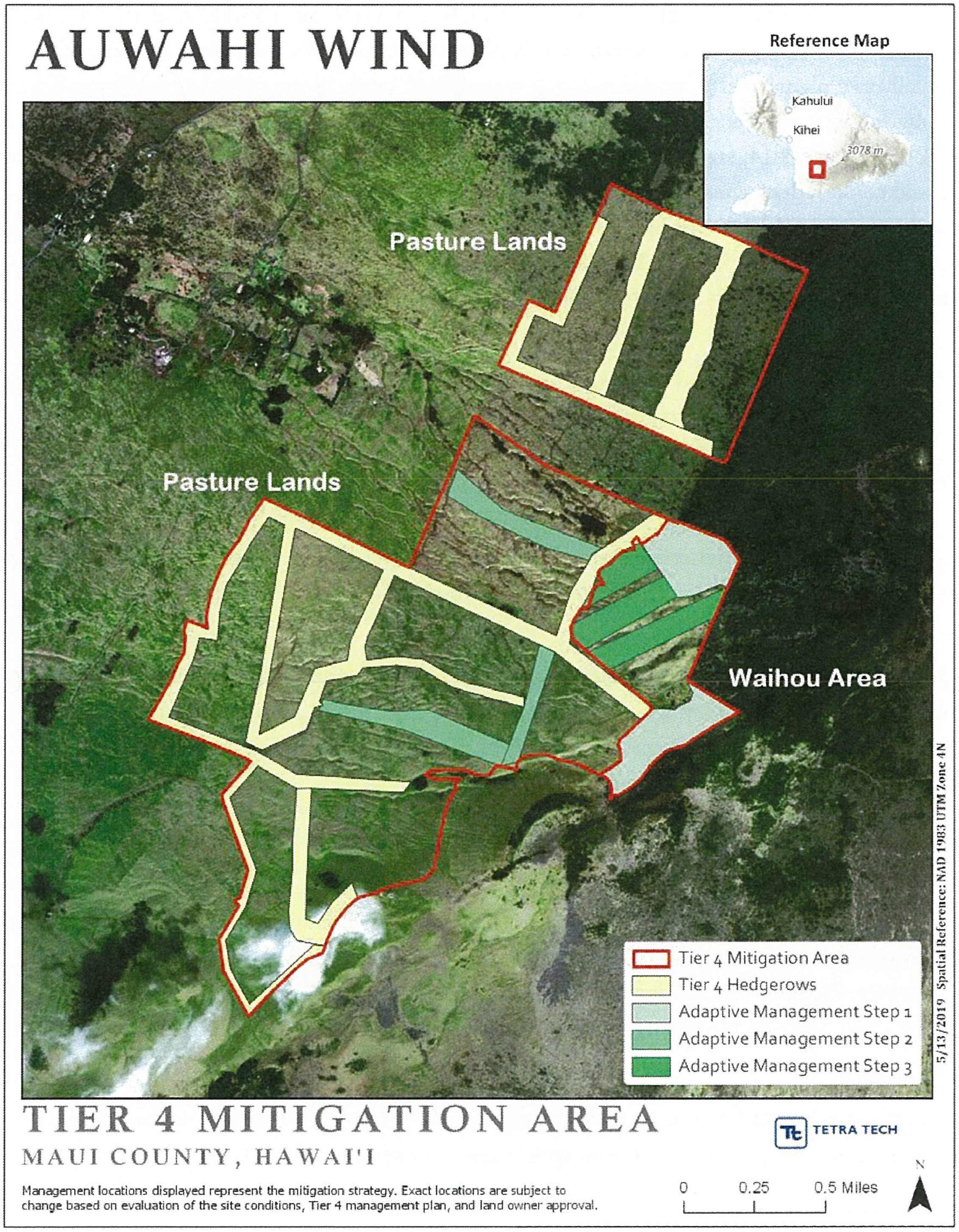


Figure 6-6. Management Plan for the Reforestation of Hedgerows

Within the hedgerows, trees will be planted to a density of approximately 200 trees per acre or 15-foot (4.6-m) spacing. The hedgerows will be at least 80 feet wide (6 trees across) to provide linear landscape features, wind breaks, and foraging substrates for the Hawaiian hoary bat. The width of hedgerows was developed in consultation with USGS. U.S. Geological Survey researchers indicated that the hedgerows, regardless of width, would primarily be used as a foraging substrate and potentially as a night roost[9], but day roosting would likely occur in the nearby Kula Forest Reserve. Consultation with the Ranch, evaluation of the predominant weather patterns in the area, and data from Böhm et al. (2014) suggest that hedgerows of 80 feet should provide sufficient shelter from the wind and could reduce wind speeds by over 50 percent relative to open pastures. Numerous studies of bat species using hedgerows have documented hedgerow width ranging from 15 feet or single trees in width to 80 feet (Jantzen 2012, Lacoeuilhe et al. 2018, Kelm et al. 2014, Böhm et al. 2014). Gaps in hedgerows, such as for gates, will be minimized, ideally less than 30 feet and not exceed 650 feet each.

The hedgerows will be planted with fast growing native trees and understory species. The selection of tree species will be subject to availability and the suitability of tree species for Hawaiian hoary bats. Koa (*Acacia koa*) is preferred as it is expected to provide available insect biomass, available night roost locations, and is fast growing. A'ali'i (*Dodonaea viscosa*) is preferred for the understory. Koa and a'ali'i are selected as preferred hedgerow species because they have been demonstrated to be associated with both an increased abundance and diversity of insect species (Peck et al. 2015, Auwahi Wind 2018), including (Coleopterans) and moths (Lepidopteran), that are prey items for Hawaiian hoary bats (Todd 2012).

The hedgerows are intended to be fenced to prevent ungulates from damaging the out-planted trees. Auwahi Wind will utilize existing fences where available and install additional fencing[10] to surround the reforestation areas where necessary to prevent the ingress of ungulates and promote the long-term habitat suitability of the reforested areas.

Water Feature Management

Water Trough Egress Structures

Following recommendations from BCI for bats in general (Taylor and Tuttle 2007), Auwahi Wind will retrofit the existing troughs with wildlife egress structures. The egress structures ensure that any bats or other wildlife which fall into the troughs are able to escape and avoid drowning. The retrofit of troughs will decrease the risk of drowning for available water troughs within the Mitigation Area.

Pond Installation

Auwahi Wind will install two new ponds to increase the availability of water sources in the Mitigation Area. The ponds will have an approximate minimum size of 20 feet (6.1 m) in diameter

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[9] Night roosting is differentiated from day roosting. Night roosting bats use available substrates to rest and digest after eating.

[10] All fencing used will be bat-safe, and free of barbed wire.

and a volume of 50,000 gallons. The minimum size of the pond was selected based on BCI recommendations for ponds which can be utilized by most bat species, and a greater surface area will be utilized where possible. The exact size and shape of the ponds will depend on the site conditions. Larger ponds are currently utilized by hoary bats at the nearby Duck Ponds site, and the installation of such ponds would be expected to significantly increase bat foraging and drinking resources. The pond design would incorporate varying water depth to facilitate insect species associated with shallows that serve as prey for bats. The ponds will be fenced to exclude cattle, and such fencing will be sufficiently far from the pond so as not to pose a collision hazard for bats. The existing ponds are naturally replenished by rainfall, which can be up to 60 inches per year (Ulupalakua Ranch, personal communication, 23 October 2018). The newly installed ponds would be expected to be naturally replenished by rainfall as well. Should rainfall be insufficient, management of the water supply will be modified through adaptive management (Section 6.2.4.7).

Fire Prevention

Fires are identified as one of the threats to the Hawaiian hoary bat (Section 3.8.1.2), and are a constant threat in Hawai'i, having increased fourfold in recent decades (Trauernicht and Pickett 2016). In Leeward Haleakalā, fires are recorded between Ulupalakua and Kaupo gap regularly. Fires in Kula State Forest reserve are rare but devastating, with major fires recorded in 1954, 1984, and 2007. In 2007, one of the most devastating wildfires burned 2,300 acres of the Kula Forest Reserve. The 2017 Kula Forest Reserve management plan cites this as the most devastating fire to happen in Hawai'i in decades. Fires threaten to destroy essential bat roosting habitat in the Kula State Forest reserve, Kanaio Natural Area Reserve, Waihou Area, and other available roosts. Additionally, fires can destroy the vegetation and insects which support Hawaiian hoary bat foraging. Therefore, fire prevention actions taken by Auwahi Wind will provide additional protection of bat foraging and roosting habitat.

In wildland firefighting, helicopters carrying 100-gallon tanks are used to supply water to prevent the spread of the fire. DLNR Division of Forestry has been seeking additional water sources in the Leeward Haleakala area but has been unable to secure funding and landowner support (Lance DeSilva, personal communication, August 10, 2018). The two 50,000-gallon ponds described above, sited adjacent to the Kula Forest reserve, will be designed to facilitate the aerial firefighting efforts essential for wildland fire prevention and serve as dip tanks. The addition of these larger ponds will allow for helicopters to fight fires to protect not only the Mitigation Area, but also adjacent lands including the Kula State Forest Reserve, Waihou Area, and the Kanaio Natural Area Reserve. The pond would be replenished over time from available water sources (i.e., rainfall).

Legal Protection

A permanent conservation easement will be conveyed over the Mitigation Area to the HILT. Certain covenants and restrictions will be placed on the protected Mitigation Area and shall be funded by Auwahi Wind, LLC. This easement will not supersede the existing agricultural easement but will impose additional servitudes which are necessary and appropriate for carrying out the Mitigation

Area bat-focused conservation measures, identified in the proposed Tier 4 Mitigation plan. As the easement grantee, HILT will ensure compliance with the covenants, terms, conditions and restrictions contained in the easement. Where the conservation easement differs from the agricultural easement the more restrictive easement shall apply.

The additional protections or restrictions which will be imposed on the Mitigation Area through the conservation easement include:

- Prohibiting removal of trees over 15 feet tall during the bat pupping season (April 1 through September 15);
- Protection of the hedgerows from removal;
- Maintaining ponds according to this mitigation plan;
- Prohibitions on the use of insecticides;
- Prohibiting artificial stocking of ponds with fish known to reduce insect populations; and
- Prohibiting the use of barbed wire when installing fencing or other such structures.

The parcel management provided by HILT includes:

- Holding rights surrendered by the landowner;
- Protection and preservation of the property set forth in the easement;
- Enforcement of the restrictions put forth in the easement; and
- Access to the lands in the easement for annual or more frequent monitoring for compliance with easement conditions.

The legal protection of the parcel ensures that future management actions are consistent with conditions that are favorable to bats, that are provided by the management actions above. These restrictions would prohibit removal of the hedgerows for all future land owners ensuring baseline reforestation efforts outlined above are maintained for many generations of bats. Koa is a long-lived species and thus would benefit many generations of bats. The maximum age of koa recorded by the U.S. Department of Agriculture (Baker 2009) range between 50 and 80 years. Koa can live much longer than 80 years, but the length of the data sets limit the maximum ages recorded. Therefore, the legal protection outlined here would protect the reforested hedgerows for an additional 50 to 80 years or more without additional restoration efforts. The addition of ponds is documented to facilitate bat use as described above. The restrictions on insecticides provide assurances that the insect prey is not removed for ranching (or other) purposes. The prohibition on the stocking of ponds with insectivorous fish prevents the features installed from being degraded or reduced in their suitability to support the additional bats protected in this plan. Finally, the prohibition on the use of barbed wire in the easement confirms that the threat of snagging bats (a documented threat) is an inconsistent land use.

6.2.4.3 Take Offset/Net Benefit

The Auwahi Wind Tier 4 mitigation package provides a combination of permanent habitat preservation, habitat restoration and enhancement, and research measures for the Hawaiian hoary bat; each mitigation measure is identified as a priority for recovery of the species by the ESRC Bat Guidance (DOFAW 2015) and the USFWS Recovery Plan (USFWS 1998). The mitigation package provides permanent legal protection of 1,752 acres, which are located adjacent to the Kula Forest Reserve and the Pu'u Makua restoration area, larger areas that support bats. In addition, the prescriptive management actions will enhance bat foraging and roosting habitat. As currently utilized, the 1,752 acres are of only marginal quality as bat habitat, and without Auwahi's bat-focused management plan, its suitability for bats will likely decrease over time. The combination of location, permanent legal protection, habitat restoration and enhancement, and habitat management, will fully offset the take of 60 Hawaiian hoary bats and provide a net benefit to the species. This multi-faceted mitigation approach is consistent with the ESRC Bat Guidance which states that habitat restoration that enhances or increases forested and foraging areas for bats is an optimum mitigation approach (DOFAW 2015).

USFWS and DOFAW consider protecting or enhancing habitat within the CUA of a bat as a benefit to the species. An acreage-based offset of 20.3 acres per bat is based on the best available science and is supported by USFWS (USFWS 2018) and DOFAW (DLNR 2018).[11] The Auwahi Tier 4 mitigation area exceeds this offset standard by permanently preserving approximately 29 acres per bat (1752 acres/60 bats = 29.2 acres/bat). Thus, utilizing the agencies' 20.3 acres per bat standard, the Auwahi Tier 4 mitigation actually offsets the take of 86.3 bats (1,752 acres ÷ median CUA of 20.3 acres per bat = 86.3 bats).

Auwahi's habitat restoration, enhancement and management measures for the 1,752 acres ensure that the benefits to bats of the Tier 4 mitigation package will be substantially greater than only acreage-based land preservation. These additional Tier 4 mitigation measures were developed to maximize the benefit to bats and increase connectivity to other nearby protected parcels containing bat habitat. The combination of hedgerows, water features, and grazed areas creates a concentration of optimal foraging resources, documented in numerous studies to increase bat activity. Bats are likely to overlap in the use of the Mitigation Area; the mitigation actions in Tier 4 target foraging resources, and foraging ranges are known to overlap (Bonaccorso et al. 2015, Bellwood and Fullard 1984). Hawaiian hoary bats are likely to have a roost outside the Mitigation Area, suggesting less than 20.3 acres per CUA will be utilized within the Mitigation Area. Bat capture rates increase by a factor of 3.3 for every 6.21 miles of additional edge (Duff and Morrell 2007). Applying this metric linearly, the new edge habitat in the Mitigation Area should increase bat capture rates by a factor of 12 or more. This is

[11] "We have determined the HWA [Helemano Wilderness Area] project continues to meet FWS guidance and the benefits of the project are anticipated to offset, at a minimum, the take of 55 bats (Tier 4) based on a median male bat core use area of 20.3 acres." (USFWS 2018).
"We concur with the USFWS . . . that mitigation credit for the Helemano Wilderness Area acquisition is properly assessed . . . Based on a median core use area of 20.3 acres per bat, this equates to a mitigation credit of at least 55 bats. We confirm that we agree with this method of calculating mitigation credit, including assessment based on the median bat core use area." (DOFAW 2018).

further evidence that the benefit of the Tier 4 mitigation package will far exceed the 60 bats necessary for the offset of take authorized in Tier 4.

Time is a key factor to consider when evaluating the impact of mitigation actions. The conservation easement will be permanent, and thus will protect the out-planted koa and other native tree species which are expected to last more than 50 years (regeneration of trees in the hedgerows will likely produce much longer benefits). Similarly, the newly installed water features, and removal of barbed wire will last well beyond the permit term. This will continue to provide new habitat benefits for five or more generations of bats, or a total of at least 300 bats. These measures will provide benefits to bats that will extend well beyond the term of the incidental take authorizations and accrue to multiple generations of bats.

Auwahi Wind's Tier 4 mitigation provides additional benefits to bats by reducing three known risks to bats: removing barbed wire, adding wildlife egress structures to water troughs, and providing new water sources for preventing wildfires. Hawaiian hoary bats are documented to have been snagged on barbed wire; barbed wire removal within the mitigation area increases the bats survivability. Hawaiian hoary bats have been documented to drown in pools, and therefore installation of wildlife egress structures reduces the likelihood of that occurring. Furthermore, to reduce the potential for wild fires which can destroy habitat, Auwahi Wind is creating new ponds to be used as dip tanks to prevent fires within and adjacent to the Mitigation Area. These new year-round water sources will increase the chances of preventing devastating fires such as the destructive 2,300-acre fire that occurred in the adjacent Kula Forest Reserve in 2007.

The Tier 4 package also includes several research elements. Auwahi Wind's Tier 4 mitigation provides a research-quality monitoring regime that exceeds what is necessary to demonstrate compliance. Mitigation monitoring incorporates: 1) thermal video for bat behavioral studies, 2) insect (i.e., prey) assessment, and 3) an extensive acoustic monitoring protocol to provide valuable insight into bat life history, habitat needs, and responses to management actions. Additionally, Auwahi Wind will also conduct a single-year occupancy study of the Hawaiian hoary bat on Leeward Haleakalā as described in Section 6.2.3. These studies enhance the benefits that land preservation and habitat management (described above) provide to the bat and are critical to the recovery of the species.

In addition to the biological demonstration of benefits outlined above, the Tier 4 mitigation meets and exceeds the bat mitigation recommendations in the ESRC Bat Guidance (DOFAW 2015). The purpose of the ESRC Bat Guidance is "to develop cohesive, consistent guidelines for project proponents attempting to avoid, minimize, and mitigate for incidental bat take, and for the regulators tasked with overseeing those projects." The ESRC Bat Guidance first "suggests that an appropriate estimated cost for mitigation take of one bat is $50,000. This may be applied to different types of mitigation options outlined below. . . ." The Guidance then presents three mitigation options:

1. Habitat Management (forest restoration or wetland restoration). The Guidance states that forest restoration mitigation projects should be calculated based on a rate of 40 acres per bat.

2. Land Acquisition. The Guidance states that land acquisition "provides benefits when the acquisition safeguards the land from future development, protects existing habitat, or provides an opportunity for restoration/creation of habitat." The Guidance does not recommend any specific amount of per-bat mitigation acreage. Instead, the Guidance states that "Larger parcels are typically preferable to smaller parcels. However, the location of a smaller parcel (e.g., adjacent to another larger area that supports bats or is being restored to support bats) could make it more attractive as a mitigation site." The Guidance goes on to say that Land acquisition proposals will be evaluated based on the following factors: acquisition alone or acquisition plus a management plan, current status of and threats to the parcel, size of parcel, and whether the acquisition and preservation will be in perpetuity.

3. Research. The Guidance states that research "is not generally a preferred mitigation strategy" but can be used where research "can enable better management of the species." "In order for research to be credited as mitigation, research projects should be targeted to provide information on better management actions for the Hawaiian hoary bat that will lead to increasing the recovery of the species." The Guidance then identifies specific research priorities.

The estimated cost of Auwahi's multi-faceted Tier 4 mitigation package is approximately $63,700 per bat (Appendix I, including adaptive management), which exceeds the ESRC's recommended $50,000 benchmark by more than 27%. Auwahi has applied that cost mainly to the land acquisition and habitat management mitigation options, as detailed above, consistent with the ESRC Bat Guidance.

The amount and types of multi-faceted mitigation measures included in the Tier 4 mitigation package provide reasonable certainty that the mitigation will provide a net benefit to bats and increase the likelihood of the species' recovery. This reasonable certainty is further supported by the very conservative nature of the underlying take estimates. As explained previously, take is estimated using the 80-percent credible limit, and estimates of mortality are increased relative to estimates at the 50-percent credible limit (Appendix H). Take estimates assume all females taken between April 1 and September 15 have dependent young, and that all young lost as a result of Project operation would have survived to adulthood. These conservative assumptions thereby purposefully overestimate likely impacts to the bat. By fully mitigating for this likely overestimate of take impacts, the level of certainty regarding the effectiveness of the mitigation package is greatly increased.

In summary, the mitigation actions will lead to permanent protection of and substantial increases in the use of the Mitigation Area by Hawaiian hoary bats resulting in an overall significant net benefit to the species and increasing the likelihood of recovery. As identified above, benefits of the Tier 4 mitigation package include:

- Providing a multi-faceted mitigation plan that includes land acquisition, bat-focused habitat management, and research;
- Permanently protecting and preserving 1,752 acres of bat habitat;

- Increasing bat foraging and night roost habitat through enhancements of pastures with new hedgerows of native canopy and understory species;
- Creating additional water sources in new ponds, adding year-round water availability;
- Enhancing connectivity to other State reserve areas provided by the Mitigation Area's location;
- Benefiting multiple generations of bats over the life of the permit and beyond;
- Removing barbed wire that is a supplemental benefit to generations of bats that extend beyond the term of the incidental take authorizations;
- Increasing the survivability of bats with installation of water egress structures;
- Reducing the risk of wildfires with installation of new ponds with benefits that extend beyond the term of the incidental take authorizations;
- Implementing a research-quality monitoring regime which will provide valuable insight into the behavior, prey, life history, habitat needs, and responses to management actions;
- Providing critical research into the landscape level occupancy and distribution of the Hawaiian hoary bat, identified by the ESRC to be necessary for the recovery of the species;
- Consistency with the ESRC Bat Guidance which states "… the ESRC suggests that an appropriate estimated cost for mitigating take of one bat is $50,000" (DOFAW 2015). The Tier 4 mitigation estimated cost is $63,700 per bat (Appendix I); and
- Reducing the uncertainty in how to manage lands for bats.

6.2.4.4 Measures of Success

Because the Hawaiian hoary bat is a solitary tree roosting species, monitoring can be difficult. Tools for assessing feeding in a given area have been identified to assess the impacts of mitigation. Efforts at proxy measurements have focused on acoustic monitoring of bat activity, and evaluating calls has been recommended by Hawaiian hoary bat research (Gorresen et al. 2018, Todd 2012). Additionally, overall population trends and habitat occupancy on Maui have not been studied and such a baseline may take years to determine.

Auwahi Wind has developed success criteria to ensure that the objectives of protecting and enhancing bat foraging and roosting habitat are being met. Additionally, the monitoring (see Section 6.2.4.5) is designed to determine the overall trends in calls for the site.

Success criteria:

- Protect the mitigation parcel in perpetuity through a conservation easement including protections outlined in Section 6.2.4.2 with oversight of the parcel by HILT (or other appropriate conservation entity).

- Install two additional ponds in the Mitigation Area according to this management plan, or other number as specified through adaptive management.
- Increase forest cover to 20 percent within the pasture parcels through hedgerow reforestation at approximately 200 trees per acre, or other cover and parcels as specified through adaptive management.
- Record an increase in bat activity through acoustic monitoring over the baseline monitoring year(s), see Monitoring below. The statistical power with which the increase is recorded will also be reported.
- Summarize and report the results of monitoring (Section 6.2.4.5) in annual reports.

Long-term success criteria:

- Ensure mitigation parcel is managed according to the conditions within the conservation easement including protections outlined in Section 6.2.4.2 with oversight of the parcel protection by HILT (or other applicable entity).

6.2.4.5 Monitoring

As identified above, the current tools available to monitor for Hawaiian hoary bats are limited, which limits the ability to determine population size and population effects after implementation of management actions. The common methods for monitoring bats are acoustic monitoring, thermography, radio tracking, and mark-recapture. Acoustic monitoring has been most widely used, but recent studies (Gorresen et al. 2017) have shown that a bat may traverse acoustic detectors without calling, thereby causing underestimation of bat activity in the monitored area. The acoustic detectors also cannot provide counts of individuals. Therefore, acoustic monitoring is most suitable for long-term or spatially distributed studies. Thermography is both expensive to implement and has the limitation of being directionally focused, limited in focal depth, and unable to differentiate if bats are transiting the area or foraging. Thermography is valuable for specific applications, such as behavior monitoring. Mark-recapture studies are a traditional tool used for estimating population sizes. Bats have been difficult to capture, and recapture of bats are rare; for this reason no population-level mark recapture studies have been performed to date. Furthermore, GPS transmitter technology is not yet sufficiently light (less than 5 percent of body mass, or 0.4 grams) to be used on a Hawaiian hoary bat. Site-specific considerations also have implications for study design. Prior studies attempting to utilize radio tracking in the Mitigation Area were precluded by the unsuitability of the site due to electromagnetic interference from nearby transmission sources and USGS recommended no further telemetry studies there (Auwahi Wind 2017).

The primary monitoring success criteria will be to discern an increase in bat activity at the site. Secondary goals include determining the impacts of management actions and verification that management actions are consistent with the management program. Overall, the ability to estimate the actual bat population is limited by the available tools, and determining population size and population impacts have been difficult to discern. The management actions target increasing foraging habitat; therefore, using acoustic monitoring to monitor calls is proposed as the most appropriate tool to assess the impacts of the management.

Acoustic Monitoring

Acoustic monitoring will be the primary means of assessing the bat utilization at the Mitigation Area. Increasing foraging at the Mitigation Area is an essential part of the objective for the proposed Tier 4 Mitigation. The total number of calls will be documented. Acoustic monitoring provides information on the level of use or activity. Areas with greater levels of acoustic activity are assumed to provide better habitat than sites with lower activity (Frick 2013). The inclusion of all calls, rather than specifying call types (i.e., feeding buzzes) is supported by recent literature which notes the lower amplitude of feeding buzzes makes them more difficult to detect, and the monitoring of all calls is an appropriate measure of abundance (Gorresen et al. 2018).

Acoustic detectors[12] will be placed across the Mitigation Area at 10 sampling locations targeting each sub-habitat: open grasslands, forest edges (hedgerows or otherwise), and water troughs, for a minimum of 30 detectors plus one acoustic detector at each pond (the number of sampling locations is subject to change after power analysis). An additional ten locations will be identified across the landscape. At these ten locations, up to five additional detectors will be selected annually to collect monitoring data. Baseline monitoring will also be conducted at up to five locations outside of the Mitigation Area (exterior detectors) in appropriate similar habitat. The exact location of detectors will be selected from a grid of 328 x 328-foot cells overlaid on the site. The cells will be selected with generalized random tessellation stratified sampling. The random selection process will identify cells containing suitable sampling locations and the first ten suitable sites of each type will be selected. An approximation of the distribution of monitoring locations is detailed in Figure 6-7. Current acoustic detectors have an approximate detection radius of 30 feet. Detectors sited at water sources will be less than 30 feet from the water source to capture bat activity associated with troughs and ponds. Detectors at forest edges will be placed 30 feet from the forest edge to capture the anticipated peak in activity between zero and 60 feet from the forest edge.

Several potential confounding factors may influence the acoustic detections at exterior detectors including:

1. The flight distance of Hawaiian hoary bats is up to 7 miles, and it is not known how far the effects of the mitigation actions will impact the utilization of the surrounding area;
2. The climate conditions change significantly less than 0.5 miles to the east of the Mitigation Area as the topography transitions to the leeward side of the island;

[12] Detector selection will be based on the current industry standard. Changes in detectors will be minimized, documented, and for a change in detectors, a comparison of the two will be documented, ideally being a period of overlap that would allow direct comparison of results.

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Forestry and Wildlife
Honolulu, HI, 96813

August 23, 2019

Chairperson and Members
Board of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

SUBJECT: REQUEST FOR APPROVAL OF AMENDMENTS TO THE INCIDENTAL TAKE LICENSE AND HABITAT CONSERVATION PLAN FOR THE AUWAHI WIND ENERGY PROJECT ON THE ISLAND OF MAUI, HAWAI'I, TAX MAP KEY: 1-9-001:006.

Submitted for your approval are the Amendments to the Incidental Take License (ITL) and the Habitat Conservation Plan (HCP) for the Auwahi Wind Energy Project (Project), on the island of Maui, Hawai'i. Amending the ITL and HCP are necessary because the take of the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) has exceeded the permitted take authorized in the 2012 HCP and ITL. The amendments do not request changes for any of the other covered species in the 2012 HCP and ITL.

BACKGROUND:

Auwahi Wind operates an 8-turbine, 21-megawatt wind energy generation facility on Ulupalakua Ranch in the southern half of Auwahi Ahupaua'a on Maui, Hawai'i. Auwahi Wind was issued an Incidental Take License (ITL) designated ITL-17 in February 2012 for incidental take including the Hawaiian Hoary Bat (HHB). The bat take authorized was 19 adults and 8 juveniles over the course of the 25-year permit term and later converting juvenile bats to adults, resulting in an adjusted approved take permit for 21 bats. In June 2016, model estimates showed that the calculated bat take limit of 21 had been reached. Auwahi Wind has requested an amended HCP and amended ITL to address impacts to the bats and increase the incidental take for this species over the remainder of the 25-year permit term. Low wind speed curtailment is proposed as an impact minimization measure for the bats. Auwahi Wind proposes no changes to the approved HCP and ITL for the incidental take and mitigation of Hawaiian Petrels, Nene, or Blackburn's Sphinx Moths. As of the end of 2018, the take of HHB by the project is estimated with 80% confidence to be at or below 46. Four additional bat fatalities have been observed in calendar year 2019 as of August 8, 2019.

INCIDENTAL TAKE AND MITIGATION PROPOSED:

The project has the potential to result in additional incidental take of species listed under the Federal Endangered Species Act and State Endangered Species Statute. Incidental take is determined from direct take and indirect take because it is possible that the death of a listed adult during the breeding season could result in loss of eggs or dependent young. Auwahi Wind has requested the addition of Tiers 4, 5, and 6 to the Hawaiian Hoary Bat incidental take Tiers 1, 2, and 3 in the existing approved HCP and ITL. Table 1 summarizes the take requested for the species covered in the HCP Amendment.

Table 1. Take Levels for the Hawaiian Hoary Bat Requested by Tier
(Revisions to the take in the February 2012 HCP and ITL are shown bold with underlined text.)

Common Name	Scientific Name	Tier Level	Requested Incidental Take Authorization
Hawaiian Hoary Bat ʻŌpeʻapeʻa	*Lasiurus cinereus semotus*	Tier 1	5 adults/immatures and 2 juveniles (5 bats*)
		Tier 2	10 adults/immatures and 4 juveniles (11 bats*)
		Tier 3	19 adults/immatures and 8 juveniles (21 bats*)
		<u>Tier 4</u>	**<u>81 bats</u>**
		<u>Tier 5</u>	**<u>115 bats</u>**
		<u>Tier 6</u>	**<u>140 bats</u>**

*Juvenile take, which is not expected to occur at a wind energy site, was reinterpreted subsequent to issuance of the 2012 ITL by DLNR and US Fish and Wildlife Service.

Mitigation for the Hawaiian hoary bat incidental take for Tier 4 would consist of habitat restoration that included planting of hedgerows and two small ponds as water sources within 1,750 acres of degraded forest/pasture in the Waihou, Duck Ponds, Cornwell, and Kaumea Loko areas of Maui, entering into a conservation easement for the mitigation parcels, and bat monitoring. Mitigation for Tiers 5 and 6 is tentatively proposed as land restoration/management at the Kamehamenui Forest at Kula, Maui. The mitigation actions there are intended to complement and build upon DLNR's planned conservation actions on that parcel.

<u>PUBLIC INVOLVEMENT</u>

The Division released the draft HCP for public comment in the December 8, 2018, Office of Environmental Quality Control (OEQC) Environmental Notice with a deadline for comment specified as February 21, 2019. During the comment period, the Division received formal comments from members of the public. Public comments are included in Attachment C.

As authorized by the Board of Land and Natural Resources (Board), DLNR conducted a public hearing relative to the proposed Auwahi Wind energy facility on February 15, 2019 to receive public testimony on the proposed HCP. Public Hearing comments are included in Attachment C.

<u>ENDANGERED SPECIES RECOVERY COMMITTEE (ESRC) RECOMMENDATION</u>

On February 15, 2019 the ESRC conducted a site visit to the wind energy site location. The draft HCP was reviewed by the Endangered Species Recovery Committee at regular meetings on June 19, 2019 and, following revisions, on July 25, 2019.

At the July 25 meeting five members agreed to a motion to recommend approval of the HCP to the Board. One ESRC member voted against the motion.

HRS CHAPTER 343

Related to the activities under the HCP, and pursuant to Hawai'i Revised Statutes Chapter 343, Auwahi Wind published a Draft Supplemental Environmental impact Statement (SEIS) in The Environmental Notice of the Office of Environmental Quality on December 8, 2018. The SEIS provided supplemental impact analysis based on the increased take of the Hawaiian Hoary Bat. Public comments on the Draft SEIS were accepted during the 45-day comment period and the responses included in the Final SEIS. The Final SEIS has been submitted for BLNR acceptance along with and at the same time as this final HCP Amendment.

RECOMMENDATION:

DLNR recommends that the Board:

1. Approve the Amended Incidental Take License and the Habitat Conservation Plan for the Auwahi Wind Energy Project, on the island of Maui, Hawai'i.

   By approval of the Incidental Take License the Board makes the following determinations under Hawai'i Revised Statues §195D-21(b)(1)(A-C):

   (A) The plan will further the purposes of this chapter by protecting, maintaining, restoring, or enhancing identified ecosystems, natural communities, or habitat types upon which endangered, threatened, proposed, or candidate species depend within the area covered by the plan;
   (B) The plan will increase the likelihood of recovery of the endangered or threatened species that are the focus of the plan; and
   (C) The plan meets all requirements of Chap. 195D

   By approval of the Incidental Take License the Board further determines that the Habitat Conservation Plan meets all the requirements of §195D-21(b)(2).

   By approval of the Incidental Take License the Board further determines that the Habitat Conservation Plan will not violate Hawai'i Revised Statues §195D-21(c) which reads as follows:

   The board shall disapprove a habitat conservation plan if the board determines, based upon the best scientific and other reliable data available at the time its determination is made, that the cumulative activities, if any, contemplated to be undertaken within the areas covered by the plan are not environmentally beneficial, or that implementation of the plan:
   (1) Is likely to jeopardize the continued existence of any endangered, threatened, proposed, or candidate species identified in the plan area;
   (2) Is likely to cause any native species not endangered or threatened at the time of plan submission to become threatened or endangered;
   (3) Fails to meet the criteria of subsections (a) and (b); or

(4) Fails to meet the criteria of section 195D-4(g).
The habitat conservation plan shall contain sufficient information for the board to ascertain with reasonable certainty the likely effect of the plan upon any endangered, threatened, proposed, or candidate species in the plan area and throughout its habitat range.

2. Authorize the Chairperson of the Board of Land and Natural Resources to issue the Amended Incidental Take License.

Respectfully submitted,

David G. Smith, Administrator
Division of Forestry and Wildlife

APPROVED FOR SUBMITTAL:

Suzanne D. Case, Chairperson
Board of Land and Natural Resources

Attachment A: Habitat Conservation Plan Amendment
Attachment B: Amended Incidental Take License
Attachment C: Public Testimony and Public Comments

AUWAHI WIND FARM
HABITAT CONSERVATION PLAN

Final Amendment

Prepared for

Auwahi **Wind**

Auwahi Wind Energy LLC

Prepared by

TETRA TECH

July 2019

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ACRONYMS AND ABBREVIATIONS

AIC	Akaike information criterion
asl	above sea level
Auwahi Wind	Auwahi Wind Energy LLC
BCI	Bat Conservation International
CUA	core use area
DLNR	Hawai'i Department of Land and Natural Resources
DOFAW	Division of Forestry and Wildlife
EoA	Evidence of Absence
ESA	Endangered Species Act
ESRC	Endangered Species Recovery Committee
ESRC Bat Guidance	ESRC Hawaiian Hoary Bat Guidance Document 2015
GIRAS	State of Hawaii Geographic Information Retrieval and Analysis System
GIS	geographic information system
HCP	Habitat Conservation Plan
HECO	Hawaiian Electric Company
HILT	Hawaiian Islands Land Trust
HRS	Hawai'i Revised Statute
ITL	incidental take license
ITP	incidental take permit
km	kilometer
kV	kilovolt
LOC	letter of credit
LWSC	low wind speed curtailment
m	meter(s)
m/s	meters/second
MECO	Maui Electric Company
Mitigation Area	Auwahi Wind's Hawaiian hoary bat Tier 4 Mitigation Area, located on 1,752 acres of Leeward Haleakalā, on Ranch land
MW	megawatt
NAR	Natural Area Reserve
PCMP	post-construction monitoring plan
PPA	power purchase agreement

Project	Auwahi Wind Farm
Ranch	Ulupalakua Ranch
RPM	rotation per minute
SSMIP	Site-Specific Mitigation Implementation Plan
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WTG	wind turbine generator

1.0 INTRODUCTION AND PROJECT OVERVIEW

1.1 INTRODUCTION

Auwahi Wind Energy LLC (Auwahi Wind) was issued an incidental take permit (ITP) from the U.S. Fish and Wildlife Service (USFWS), and an incidental take license (ITL) from the Hawai'i Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW), for the Auwahi Wind Farm (Project) on February 24 and February 9, 2012, respectively. The ITP/ITL and associated Habitat Conservation Plan (HCP; Auwahi Wind 2012) provide coverage for incidental take of four species listed under the federal Endangered Species Act (ESA) and State of Hawai'i endangered species statutes that have the potential to be impacted by the Project, including ʻōpeʻapeʻa or Hawaiian hoary bat (*Lasiurus cinereus semotus*), the ʻuaʻu or Hawaiian petrel (*Pterodroma sandwichensis*), nēnē or Hawaiian goose (*Branta sandvicensis*), and the Blackburn's sphinx moth (*Manduca blackburni*). The ITP and ITL each have a term of 25 years and are effective through 2037.

The Project, which began commercial operation on December 28, 2012, is located on eastern Maui, Hawai'i, on Ulupalakua Ranch (Ranch). The Project consists of eight Siemens 3-megawatt (MW) wind turbines, augmented with an 11-MW battery storage system. Ancillary facilities include an underground electrical collection system, an operations and maintenance facility, an approximately 9-mile 34.5-kilovolt (kV) above-ground generator-tie line, and an interconnection substation (Figures 1-1 and 1-2). The planned operational period of the Project is from 2012-2032, 20 years of the 25-year permit term. In 2032, Auwahi Wind may consider extending the operational life of the Project for the remaining 5 years of the permit term through a new or revised power purchase agreement (PPA).

Auwahi Wind has prepared this HCP Amendment to support a request for an increase in the amount of take of the Hawaiian hoary bat that is authorized under the ITP/ITL. The current amount of authorized take for the Hawaiian hoary bat is 21 bats, an estimate that was based on the best available information at the time the ITP/ITL was issued (see Section 2.0). However, during the first 5 years of Project operation, Hawaiian hoary bat take has been higher than anticipated, and modeled estimations of take indicate that the Project has exceeded the currently authorized take limit, even with the implementation of additional, voluntary avoidance and minimization measures.

In 2015, Auwahi Wind initiated consultation with USFWS and DOFAW with the goal of preparing and receiving approval of an HCP Amendment (see Section 2.0) before the Project approached the currently authorized take limit. While not required under the approved HCP, Auwahi Wind concurrently initiated voluntary low wind speed curtailment (LWSC) with a 5.0 meter per second (m/s) cut-in speed, year-round, at the Project in 2015 to reduce the risk to bats. In 2018, the Project further increased the cut-in speed to 6.9 m/s from August through October as an additional minimization measure. The requested total bat take authorization for this amendment is 140 bats (119 in addition to the 21 authorized in the approved HCP). The amendment separates the requested take into three cumulative tiers of take (Tiers 4, 5, and 6) of 81, 115, and 140 bats, respectively. Discussion of tiers (including the biological justification) can be found in Section 5.1. Auwahi Wind has identified additional minimization measures to be implemented as well as compensatory mitigation, as appropriate. Mitigation and associated adaptive management for these tiers is outlined in Section 6.2. Adaptive management of minimization measures associated with take can be found in Section 7.4.

The biological goals from the approved HCP are still applicable for the HCP Amendment. Biological goals are intended to be broad, guiding principles that clarify the purpose and direction of the HCP (USFWS and NMFS 2016). The goals of the approved HCP are to:

- Avoid, minimize, and mitigate the potential effects on the Covered Species associated with the construction and operation of the Project;
- Increase the knowledge and understanding of the occurrence and behavior of the Covered Species in the Project vicinity;
- Adhere to the goals of the recovery plans for each of the Covered Species; and
- Provide a net conservation benefit to each of the Covered Species.

Additionally, the biological goals of this HCP Amendment are to:

- Minimize impacts to the Hawaiian hoary bat to the maximum extent practicable in the Project area; and
- Mitigate remaining impacts to fully offset impacts and provide a net benefit to the Hawaiian hoary bat by protecting, enhancing and/or managing Hawaiian hoary bat foraging and/or roosting habitat.

Avoidance, minimization, and mitigation measures that will be used to achieve these goals and associated objectives are described in the subsequent sections of this HCP Amendment (Sections 4.1, 6.2, and 7.4).

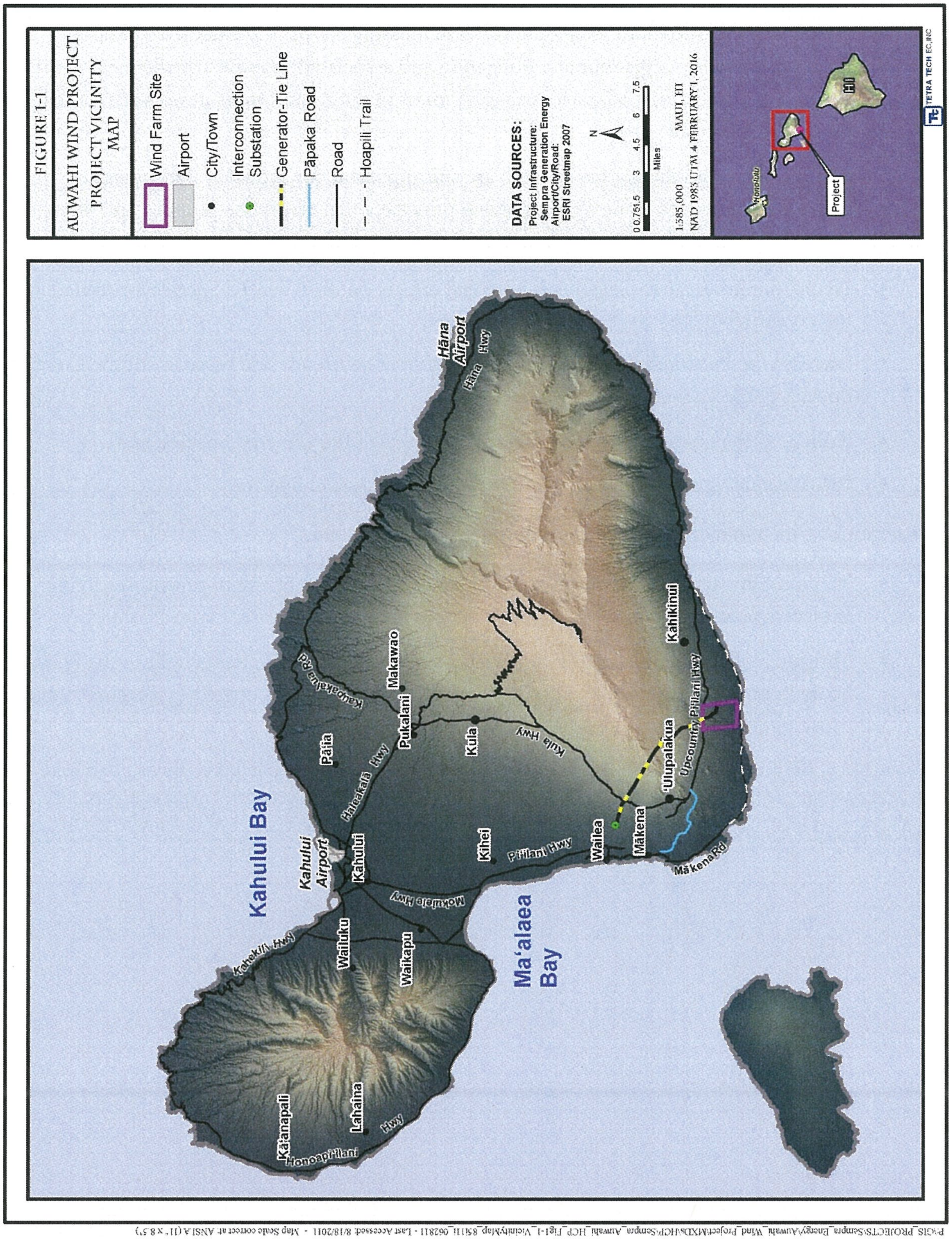


Figure 1-1. Project Vicinity Map

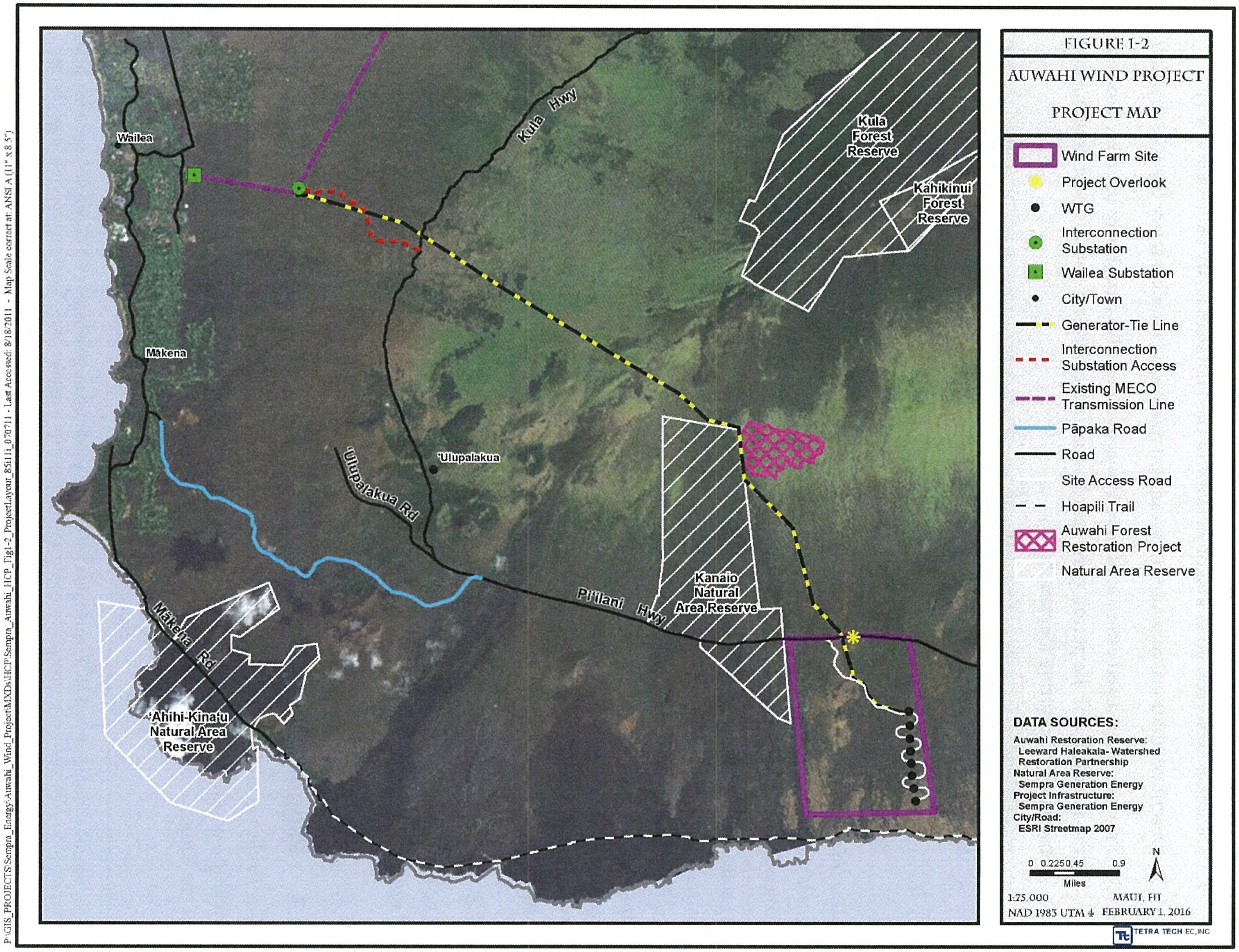


Figure 1-2. Project Map

This Amendment:

1. Describes biological goals and objectives for the Hawaiian hoary bat (Section 4.1);
2. Describes additional measures to avoid and minimize Hawaiian hoary bat take (Section 4.2);
3. Provides an updated estimate of total Project-related Hawaiian hoary bat take, projected over the remainder of the permit term based on results of Project-specific post-construction mortality monitoring (Section 5.1);
4. Presents the request for additional authorized take of Hawaiian hoary bats (Section 5.1);
5. Identifies associated additional compensatory mitigation (Section 6.2); and
6. Presents a long-term post-construction monitoring plan (PCMP; Section 7.1 and Appendix E).

New information regarding Hawaiian hoary bat ecology, distribution, and mortality that has become available since the preparation of the approved HCP has also been incorporated to support the HCP Amendment.

This document is intended as a supplement to the approved HCP. For ease of use, this document uses the same general section organization as the approved HCP, and where appropriate, individual sections from the approved HCP are updated in this document. Sections not requiring updates for this HCP Amendment are identified by the following text after the section heading: "This section requires no edits for the HCP Amendment." The approved HCP should be referenced in these cases. The original, approved HCP can be viewed and downloaded online at: http://dlnr.hawaii.gov/wildlife/files/2013/10/Auwahi-Wind-Farm-FINAL-HCP-1-24-12-R1.pdf.

1.2 Applicant Information

The applicant for this HCP Amendment is Auwahi Wind Energy LLC, a joint venture between AEP Renewables, LLC (AEP) and BP Wind Energy North America Inc. The Project is operated by AEP.

1.3 Project Description

The Project is as described in Section 1.3 of the approved HCP[1]. No physical changes to the Project facilities, or additional development is proposed under the HCP Amendment. Changes in operations of the Project associated with avoidance and minimization measures are outlined in Section 4.2.4.

[1] Section 1.1 of the approved HCP stated that the Project wind turbine generators (WTG) would have a net generating capacity of 21 MW and were expected to be curtailed at night on a regular basis based on expected Maui Electric Company (MECO) demands. Subsequently, MECO implemented a dispatch process that optimizes use of renewable energy generators, such that the Project is routinely operated at night. Each of the eight wind turbine generators is capable of generating up to 3 MW. However, even if the Project generated the full 24 MW, there is no increased risk to wildlife because the rotations per minute (RPMs) of the turbine blades are the same at 3 MW as at 2.6 MW.

The Tax Map Key (property lot identification in Hawai'i) for the HCP Amendment is (2) 1-9-001:006.

1.4 REGULATORY FRAMEWORK AND RELATIONSHIP TO OTHER PLANS, POLICIES, AND LAWS

This section requires no edits for the HCP Amendment.

2.0 DESCRIPTION OF THE HABITAT CONSERVATION PLAN

2.1 PURPOSE AND NEED FOR THE HCP

The purpose and need for the HCP Amendment is to address impacts to the Hawaiian hoary bat beyond those authorized under the existing ITP/ITL, and to request the authorization of additional incidental take for the Hawaiian hoary bat. The HCP Amendment identifies appropriate minimization measures, mitigation actions, adaptive management strategies, and monitoring requirements associated with the requested additional take. The approved HCP and the HCP Amendment both respond to the need for authorization of incidental take of listed species associated with the Project, pursuant to the ESA and Hawai'i Revised Statutes (HRS) Chapter 195D, and the need for measures to minimize and mitigate these impacts to the maximum extent practicable. The ITP/ITL application requires development of an HCP that ensures the continued existence of, and aids in the recovery of the Hawaiian hoary bat while allowing for incidental take of the species during Project operation.

Take of Hawaiian hoary bats at the Project has been higher than anticipated under the approved HCP, in part because risk to bats associated with wind energy development in Hawai'i was largely unknown and underestimated at the time the HCP was approved. Additionally, a significant amount of data has been collected that is now available to support statistical projections of future fatality rates. When the approved HCP was prepared, post-construction mortality monitoring data from Hawai'i wind farms were limited. Estimates of take were based on the best available surrogate information, such as preliminary monitoring data from one operating wind farm in Hawai'i and general comparisons of bat acoustic activity among sites, which now are shown to have underestimated collision risk for bats. Advancements in acoustic monitoring and thermography have shown that prior population estimates under-reported the abundance of the Hawaiian hoary bat (Gorresen et al. 2017). Since the development of the approved HCP, USFWS and DOFAW have adopted a more conservative standard for estimating bat take (e.g., Evidence of Absence [EoA] statistical software; see Section 5.0), which is also now used to evaluate HCP compliance. This software enables the incorporation of fatality data from previous years, or informed assumptions in the absence of such data, to model fatality rates over time, accounting for both observed and unobserved take. The model is conservative in that it does not produce a point estimate of a number of fatalities, but enables the identification of a range of fatality estimates with an upper limit defined by a user-selected confidence threshold (see Section 5.0, Appendix H).

The HCP Amendment employs the EoA statistical software and Project-specific post-construction mortality monitoring data (see Section 5.0, Appendix H), which improves the understanding of inter-annual variability in fatality rates and other Project-specific uncertainties. Thus, this HCP Amendment is anticipated to more accurately estimate the range of Hawaiian hoary bat take over the remaining years of Project operation, and better matches the current approach taken by USFWS and

DOFAW to assess ITP/ITL compliance, as compared to the approved HCP. See Appendix E for details associated with long-term post-construction mortality monitoring and compliance.

2.2 Scope and Term

The HCP Amendment does not propose any changes to the scope of the approved HCP (all areas where construction and operation of the Project and associated facilities have the potential to affect the Covered Species), or to the original permit term of 25 years (2012 – 2037).

2.3 Survey and Resources

The following resources were used during the preparation of the HCP Amendment:

- Data from Project operations (2012 – 2017);
- Results from post-construction mortality monitoring surveys (2013 – 2017);
- Acoustic bat monitoring surveys using Wildlife Acoustics monitors (July 2013 – December 2015);
- EoA fatality modeling software (version 2.0, Dalthorp et al. 2017); and
- The Endangered Species Recovery Committee (ESRC) Hawaiian Hoary Bat Guidance Document (ESRC Bat Guidance; DOFAW 2015) and subsequent verbal and written guidance and recommendations provided by USFWS and DOFAW.

3.0 ENVIRONMENTAL SETTING

3.1 REGIONAL LOCATION

This section requires no edits for the HCP Amendment.

3.2 LAND USE

This section requires no edits for the HCP Amendment.

3.3 TOPOGRAPHY AND GEOLOGY

This section requires no edits for the HCP Amendment.

3.4 SOILS

This section requires no edits for the HCP Amendment.

3.5 HYDROLOGY AND WATER RESOURCES

This section requires no edits for the HCP Amendment.

3.6 TERRESTRIAL FLORA

This section requires no edits for the HCP Amendment.

3.7 NON-LISTED WILDLIFE

This section requires no edits for the HCP Amendment.

3.8 LISTED WILDLIFE

This section requires no edits for the HCP Amendment except as provided in the subsections below.

3.8.1 Hawaiian Hoary Bat

3.8.1.1 Distribution, Population Estimates, and Ecology

The Hawaiian hoary bat is the only fully terrestrial, native mammal in the Hawaiian Islands. Recent studies and ongoing research have shown that bats have an extensive distribution across the islands (Bonaccorso et al. 2015, Gorresen et al. 2013, H.T. Harvey and Associates 2019, Starcevich et al. 2019) and breeding populations are known to occur on all of the main Hawaiian Islands except Ni'ihau and Kaho'olawe (Bonaccorso et al. 2015). Numerous research studies have been conducted on the Hawaiian hoary bat in the last decade. The bat has been detected broadly across the State and on Maui specifically. The most current studies of the Hawaiian hoary bat population come from occupancy modeling on Hawai'i Island from 2007 – 2011, which show the population of the Hawaiian hoary bat is "stable to increasing" (Gorresen et al. 2013). Documented occurrences of the

Hawaiian hoary bat from monitoring at wind farms, associated mitigation sites, and research show that the bat is more widespread and abundant than the estimate provided in the 1998 USFWS Hawaiian hoary bat recovery plan (Auwahi Wind 2017, Kaheawa Wind Power 2017, Kaheawa Wind Power II 2017, Gorresen et al. 2013, Bonaccorso et al. 2015, HT Harvey 2019).

The Hawaiian hoary bat has been observed in a variety of habitats, including open pastures and more heavily forested areas, and in both native and non-native habitats (DLNR 2015, Gorresen et al. 2013). In addition to utilizing undeveloped areas, foraging and roosting has been documented in a variety of developed areas (golf courses, urban, suburban, rural, military and industrial) on O'ahu, Maui, Kaua'i, and Hawai'i Island (Kawailoa Wind Power 2014, Jacobs 1994, USFWS 1998). Typically, this species feeds over streams, bays, along the coast, over lava flows, or at forest edges. Hawaiian hoary bats have also been documented using forest gaps and clearings, forest edges, along roads, and along hedgerows for foraging (Bonaccorso et al. 2015).

Gorresen et al. (2013) found that Hawaiian hoary bats concentrated in the lowlands during the breeding season on Hawai'i Island, and migrated to interior highlands during the non-breeding season. Limited data suggest breeding may primarily occur at lower elevations, at 3,300 feet (1,000 meters [m]) above sea level (asl) or lower; however, a pregnant female was captured in June 2017 above 5,000 feet asl (DOFAW 2015; Corinna Pinzari, USGS, personal communication).

Hawaiian hoary bats are found in both wet and dry areas from sea level to 13,000 feet asl, with most observations occurring below 7,500 feet. Although the Hawaiian hoary bat may occasionally disperse between islands and demonstrate seasonal movement within topographical gradients on the islands, long-distance migration like that of the mainland hoary bat is not documented (USFWS 1998). Seasonal and altitudinal differences in bat activity have been suggested (Menard 2001). Hawaiian hoary bats can range among habitats and elevations within a single night to target optimal local foraging opportunities (Gorresen et al. 2013, 2015. Bonaccorso et al. 2016).

Roosting Habitat

Hawaiian hoary bats are known to have solitary day roosts in tree foliage, and have only rarely been seen exiting lava tubes, leaving cracks in rock walls, or hanging from human-made structures. Foliage roosting has been documented in hala (*Pandanus tectorus*), coconut palms (*Cocos nucifera*), kukui (*Aleurites moluccana*), pūkiawe (*Styphelia tameiameiae*), Java plum (*Syzygium cumini*), kiawe, avocado (*Persea americana*), shower trees (*Cassie javanica*), ‘ōhi‘a trees (*Meterosideros polymorpha*), fern clumps, ironwood (*Casuarina equisetifolia*), macadamia (Macadamia spp.), and mature eucalyptus (*Eucalyptus* spp.) plantations; they are also suspected to roost in Sugi pine (*Cyrptomeria japonica*) stands (USFWS 1998; DLNR 2005, Gorresen et al. 2013, Kawailoa Wind Power 2013). Hawaiian hoary bats have also been observed using night roosts to rest after foraging or seek shelter from rain (Todd 2012). Generally, bats are thought to use night roosts to serve several potential functions for bats: energy conservation, digestion, predator avoidance, information transfer, and social interactions (Kunz 1982). The selection criteria of bats in general for night roosts is not well documented, but proximity to foraging grounds is suggested to be an important criterion (Knight 2009).

Breeding

Breeding activity takes place between April and August, with pregnancy and the birth of two young (occasionally one) occurring from April to June (Bogan 1972). Based on the data available, USFWS estimates the Hawaiian hoary bat reproductive rate to be 0.54 offspring per female surviving to adulthood (USFWS 2016a). Until weaning at 3 months of age, the young are completely dependent on the female for survival. Lactating females have been documented from June to August, and post-lactating females have been documented from September to December (Menard 2001). USFWS and DOFAW have interpreted this as female Hawaiian hoary bats potentially having dependent young from April 1 – September 15 (USFWS and DOFAW 2016). The lifespan of the Hawaiian hoary bat has been estimated to be a minimum of 4 years (Bonaccorso 2016) and a maximum of 10 years (DOFAW 2015).

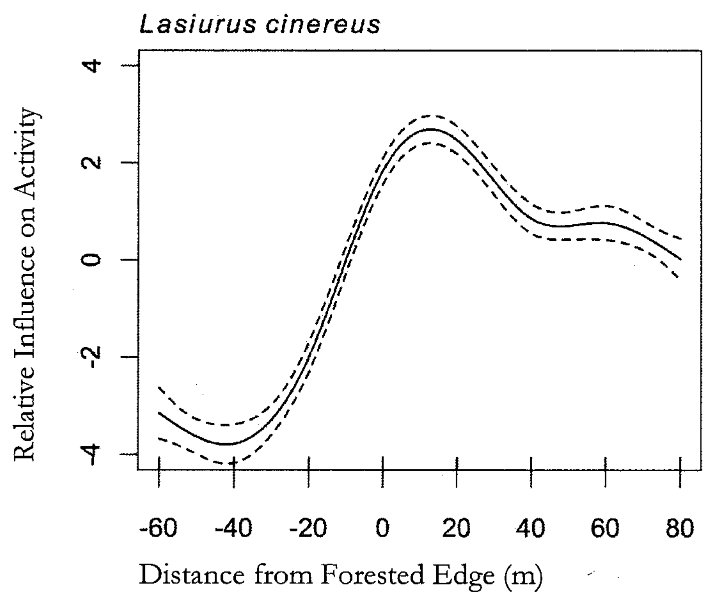
Foraging Habitat and Diet

The Hawaiian hoary bat is an insectivore, and prey items include a variety of native and non-native night-flying insects including moths, beetles, crickets, mosquitoes, and termites (Whitaker and Tomich 1983). Fecal pellet analysis and insect sampling have shown that 99 percent of the Hawaiian hoary bat diet consists of moth and beetle prey (Todd 2012). Above 2,000 feet, Hawaiian hoary bats selectively ate beetles (43 percent of diet) relative to their abundance at study sites (<4 percent of insects sampled), although species such as moths and beetles may be overestimated in fecal pellet analysis due to sampling bias. Additionally, bat activity is correlated with insect activity (Todd 2012, Gorresen et al. 2018). Bats are documented to travel up to 7 miles per night to reach foraging grounds (Bonaccorso et al. 2015).

Water provides an essential habitat component for foraging, reproductive, and basic physiological requirements for bat species. All bats, with the exception of a few frugivorous or nectivorous bats, drink water (van Helverson and Reyer 1984). Water sources have been shown to increase Hawaiian hoary bat activity relative to surrounding habitats (SWCA 2011). Mainland and Hawaiian hoary bats have been documented at artificial water sources such as reservoirs (Jackrel and Matlack 2010, Vindigni et al. 2009, Uyehara and Wiles 2009). Hawaiian hoary bats have been captured foraging for moths over open water (Todd 2012, USFWS 1998). Additionally, bat use of natural and artificial water sources as foraging substrates is well documented on the mainland and in Europe (Brooks and Ford 2005, Heim et al. 2018, Vindigni et al. 2009), specifically drinking from water troughs in arid regions of the mainland United States (Jackrel and Matlack 2010, Tuttle et al. 2006, Vindigni et al. 2009).

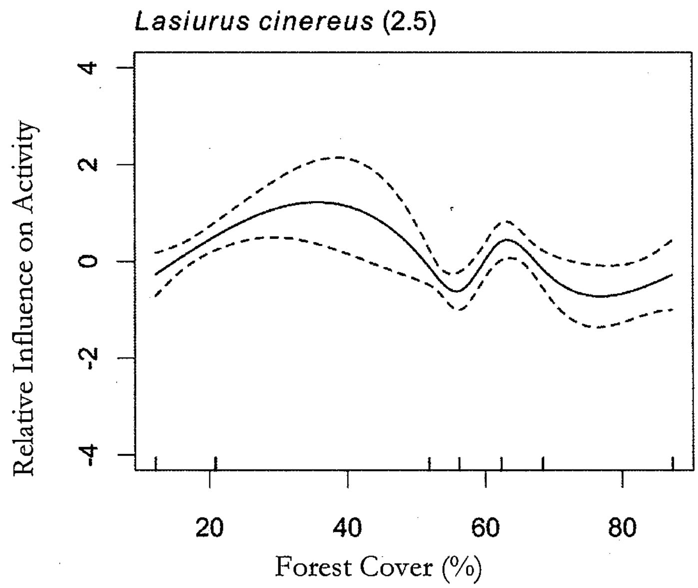
The Hawaiian hoary bat feeds primarily in edge and open habitats, which is supported by call structure, wing shape, and behavioral observations. Hawaiian hoary bats weigh about 45 percent less than mainland hoary bats, which are open area foragers (Fenton 1990), and this smaller body mass leads to lower wing loading and an increased aptitude for flying in both open and more cluttered environments (Jacobs 1996), such as edge habitats. Hawaiian hoary bats also use high-intensity echolocation calls with a mix of narrow and broadband components, which is consistent with forest edge habitat foraging behavior. Edge habitats in general provide efficient foraging habitat that minimizes commuting energy costs and maximizes foraging opportunities (Grindal and Brigham 1999). Edge habitats also provide benefits to some insect species (Langhans and Tockner 2014), as well as providing shelter where insects congregate and where bat foraging activity increases (Grindal and Brigham 1999).

Additional information on the use of edge habitat by mainland hoary bats is expected to be relevant to the Hawaiian hoary bat. Research on mainland hoary bats has evaluated the habitat density and distance from forest habitats that are correlated with higher use rates by bat species (Jantzen 2012). For mainland hoary bats, increased activity was recorded out to 262 feet from forest edges (Figure 3-1). In addition to looking at bat activity at varying distances from edge habitats, this research also included a geographic information system (GIS) analysis of the habitat at varying spatial scales to assess how the percent of forest cover influenced bat activity. At the 0.9-mile and the 1.5-mile spatial scale, a bimodal distribution with statistically significant peaks of activity were noted from 20 to 25 percent forest cover and at 70 percent forest cover. The data from the 1.5-mile spatial scale suggest increased activity up to 40 percent forest cover (Figure 3-2).



Source: Jantzen 2012, reproduced with permission

Figure 3-1. Relative Bat Activity Compared to the Distance from a Forest Edge

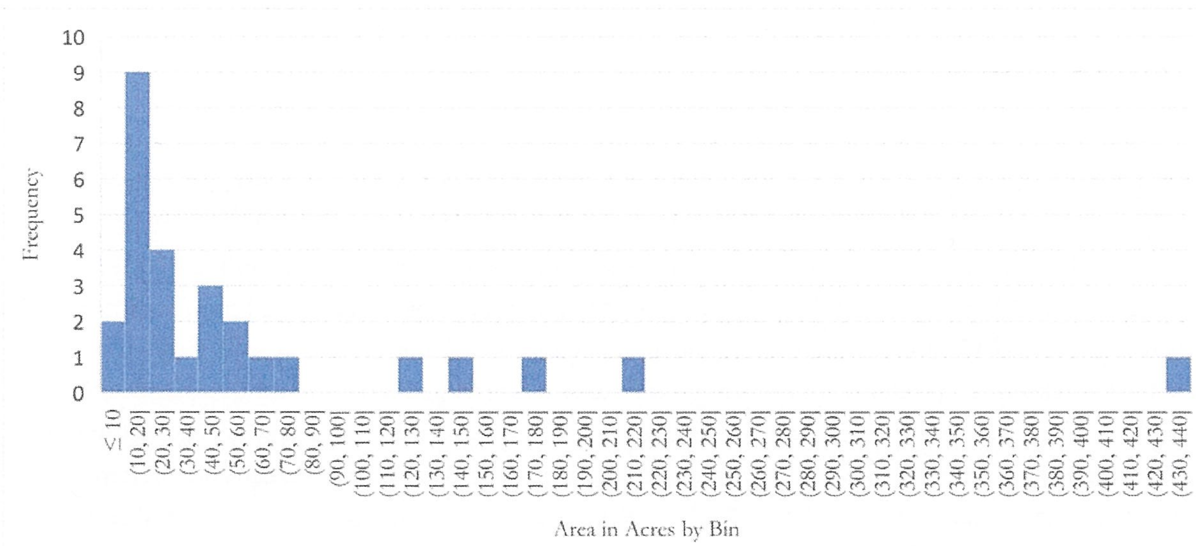


Source: Jantzen 2012, reproduced with permission

Figure 3-2. Hoary Bat Activity Relative to the Forest Density at the 1.5-mile Spatial Scale

A Hawaiian hoary bat's foraging range contains the area used by an individual bat foraging for food and movements to and from day roosts and night roosts. The Hawaiian hoary bat foraging range on Hawai'i Island in late spring, summer, and fall was moderately large (mean of 570.1 ± 178.7 acres [230.7 ± 72.3 hectares]), but foraging activity within this range was concentrated within small core use areas (CUA; 11.1 percent of mean foraging range; Bonaccorso et al. 2015). The term CUA is defined as areas within the foraging range that have very intensive use. Although this study reports no overlap in adult male CUA, overlap is documented in the CUA of sub-adults and the larger foraging ranges. Additionally, multiple bats have been observed to use the same resources, such as the 11 bats captured and tagged near the Pu'u Makua mitigation site (Auwahi Wind 2017). Thus, individual male Hawaiian hoary bats may have overlapping foraging ranges, but appear to have almost no overlap in CUA. This lack of overlap is supported by behavioral studies in which antagonistic interactions have been documented between individuals (Belwood and Fullard 1984). The median CUA of 20.3 acres is reported by DOFAW (DOFAW 2015) and the size of core use areas is illustrated in Figure 3-3. Variation in CUA size may depend on age, habitat suitability, and foraging efficiency (Bonaccorso et al. 2015, Pinzari 2014). Data from Bonnocorso et al. (2015) suggests that although there is variability in the size of CUAs[2], subadults tend to use larger core use areas than adults.

[2] In January 2019, HT Harvey presented preliminary research to the ESRC (HT Harvey 2019). The study showed bats have a broad distribution across the area surveyed. Preliminary findings from 5 bats tracked for 5 nights suggest "Bats regularly forage over a large area 2967 acres". The final report and methods for this study are not yet available.



Source: Bonaccorso et al. 2015

Figure 3-3. Histogram of Core Use Area Sizes (acres) Binned by 10 acres

Population

Literature Review

As previously identified, neither a state-wide nor an island-wide population estimate has been derived for the Hawaiian hoary bat. Current studies are working toward collecting the empirical information to be able to provide more of a statewide estimate and suggest the Hawaiian hoary bat has a relatively large population statewide and on Maui. The Hawaiian hoary bat has been detected broadly statewide and across Maui in many habitats. In most of the locations where people have made efforts to detect the Hawaiian hoary bat, they have been documented. The life history traits known for the bat suggest it is a species resilient to environmental changes. Occupancy models and genetic studies have been, and continue to be, conducted to attempt to determine population indices and effective population sizes; effective population does not necessarily equate to actual population size (Gorresen 2008, Gorresen et al. 2013). Thus, using the best available information for the bat, an estimate of an overall population range for Maui can be derived that takes into consideration land cover and occupancy in addition to use of proxy assumptions. This section describes in more detail the parameters considered for this exercise to model a population range for Maui.

The life history characteristics known for the Hawaiian hoary bat provide indicators that the population would be expected to be widespread, abundant, and resilient to change:

- The ability of the Hawaiian hoary bat to fly long distances to utilize resources;
- The utilization of a variety of tree species for roosting;
- The ability to forage in a variety of habitats;
- The utilization of a wide elevational gradient for foraging and roosting;

- The consumption of a broad array of insect species and ability to change diet species with prey availability; and,
- The high capacity for reproductive output.

Occupancy is the proportion of an area occupied by a species or fraction of landscape units where the species is present, and can be used to estimate trends (MacKenzie et al 2019). The most current studies of the Hawaiian hoary bat population come from occupancy modeling on Hawai'i Island from 2007 – 2012, which show the population of the Hawaiian hoary bat is "stable to increasing" (Gorresen et al. 2013). On Hawai'i island mean occupancy of all survey areas for all times of year was 0.63. Preliminary results from an occupancy study underway island wide on the island of O'ahu found an initial occupancy rate estimated at 0.47, results of this study are subject to change as the study progresses. The proportion of nights that bats are detected gives an indication of relative abundance across sampling sites(Frick 2013). The proportion of nights with bats detected from 2007-2011 was measured at 38 percent across all sites from Hawaii Island (Gorresen et al. 2013). In comparison, bat detections at the Project (31 percent of nights with detections, Auwahi Wind 2015), Nakula NAR (31 percent of nights with detections, Todd et al. 2016) and Pu'u Makua (38 percent of nights with detections, Auwahi Wind 2017) indicate similar bat abundance across monitored areas. Because detection rates are associated with bat abundance, there are likely similarities between the occurrence on Hawai'i Island and Maui.

Exercise in estimating Hawaiian Hoary Bat Population

Taking in to consideration the indicators and occupancy modeling parameters considered above, a population estimate exercise is described below. In the absence of a population estimate, habitat characteristics could be used as a proxy to estimate Hawaiian hoary bat populations. Maui is approximately 465,280 acres of which approximately 32.2 percent is forested (NOAA 2018). This area equates to approximately 150,000 acres of forest on Maui. Approximately 3 percent of Maui represents developed lands, or areas occupied by human structures and impervious surfaces, and an additional 3.5 percent represents barren land. This land use assessment indicates that approximately 93.5 percent of Maui consists of forest, agricultural, rangelands, and wetlands (Figure 3-4), which at varying degrees provides suitable habitat for the Hawaiian hoary bats.

This exercise will look at density and distribution to estimate a population. All studies that examine bat use in varying habitats show Hawaiian hoary bats use habitats at varying densities. To ensure that the population estimate is conservative, both the estimate of density and the distribution are conservative. The estimate provided here assumes that only 30 percent of the area of Maui, or 140,000 acres, is potentially acceptable CUA for bats. This area is roughly based on the proportion of the forested area of Maui as a proxy for bat occurrence. This proxy is based on the association with mature forest (Gorresen et al. 2013) and the need for day roosts. However, this estimate may incorporate forest lands, and portions of the agricultural, and rangelands. Of the 30 percent of habitat that could be occupied, the area estimated to be occupied by bats is 60 percent based on the observations of occupancy from published findings from Hawai'i[3] (Gorresen et al. 2013). This habitat suitability assessment serves as a proxy for the estimated extent of occurrence on Maui.

In addition to the extent of occurrence, the density of bats on Maui must also be estimated to derive a population estimate. Measurements of Core Use Area (CUA) from Hawai'i Island provide estimates of CUA in acres per bat (Bonaccorso et al. 2015):

- The median CUA is 20.3 acres (DLNR 2015); and
- The interquartile range (IQR) is from 16 acres to 58 acres.

A typical measure of statistical dispersion is the IQR. If the lower quartile CUA (16 acres) is used to represent a high-end estimate for the density of bats on Maui and the upper quartile CUA (58 acres) represents a low-end for density, the population may range between approximately 1400 to 5200 individuals.

$$Low\ Population\ Estimate = 1400\ bats \approx \frac{140{,}000\ acres * 60\%\ occupied}{58\ \frac{Acres}{Bat}}$$

$$High\ Population\ Estimate = 5200\ bats \approx \frac{140{,}000\ acres * 60\%\ occupied}{16\ \frac{Acres}{Bat}}$$

As previously identified, this population exercise provides an indication of scale and risk analysis. Despite the use of conservative estimates of the proportion of the island utilized and occupancy, the exact numbers of the population should be treated with caution as the estimates may vary if the input parameters are altered. For example, bats have been documented to have seasonal variation in use, and also documented to use non-forested areas (Auwahi Wind 2017, Todd et al. 2016). Nevertheless, this population estimate, documented bat observations, and the life history characteristics described above all suggest the Hawaiian hoary is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources.

Genetics

Recent research indicates that Hawaiian hoary bats on Maui may consist of two distinct lineages because of multiple colonization events (Baird et al. 2015, Russell et al. 2015, Baird et al. 2017). Currently only one bat species is recognized as present in Hawai'i, and it is listed as endangered; it is possible that federal and state regulatory agencies may make a revised listing determination in the future, considering new taxonomic information on the two potential lineages (DOFAW 2015). Potential impacts to the Hawaiian hoary bat are not expected to differ by lineage; therefore, the amendment should remain valid in the event of agency recognition of subpopulations.

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[3] Measurements from Hawai'i Island included primarily natural or forested habitat and found 0.63 occupancy (and the average, site-specific occupancy excluding Hilo was 0.91), suggesting the use of 0.6 is conservative.

Research

The Hawaiian hoary bat recovery plan (USFWS 1998) and the ESRC Bat Guidance (DOFAW 2015) acknowledge the benefits of additional research to further understand the ecology and life history of the Hawaiian hoary bat. The USFWS, DOFAW, and ESRC approved several research projects that are being conducted on Maui, O'ahu, and Hawai'i Island to better understand some of the key limiting factors for the Hawaiian hoary bat. These studies should provide insight into the life history, population, and habitat needs of the Hawaiian hoary bat that could inform future minimization and mitigation measures to help reduce the impacts to Hawaiian hoary bats. The research projects are anticipated to conclude between 2020 and 2022.

3.8.1.2 Threats

Overview of Primary Threats to the Species

Little is known overall about specific threats to the Hawaiian hoary bat due to a lack of data, although the data that do exist indicate that there are three major observed threats, as well as several unquantified threats that have yet to be properly evaluated. The three greatest threats causing additive mortality to Hawaiian hoary bats, based on observed fatalities and as identified in the ESRC Bat Guidance (DOFAW 2015), are wind turbines, removal of trees during the bat pupping season, and barbed wire. These threats have the potential to cause a localized reduction in bat numbers.

Wind turbines are responsible for the highest number of observed fatalities of Hawaiian hoary bats statewide, but wind facility operation is also the only activity with data from intense, long-term monitoring. The risk of collision with wind turbines can be minimized through LWSC as has been documented in several mainland studies (Arnett et.al. 2010, Arnett et al. 2013, Martin et al. 2017). LWSC is defined as restricting operation of turbines to periods when the wind speed reaches a pre-determined speed that is greater than the manufacturer's recommended cut-in speed and feathering turbine blades into the wind below that set wind speed. "Feathering" means that the wind turbine blades are pitched parallel to the wind, resulting in very slow movement of the rotor, on the order of 1 to 3 rotations per minute depending on blade length. Nighttime LWSC has been associated with reduction in risk to bats (Arnett et al. 2011) because bat activity is typically associated with periods where wind speeds are lower. As wind speeds increase, the likelihood of bat activity decreases, and collision risk correspondingly decreases.

Despite the benefit of LWSC, the risk to bats posed by wind turbines cannot be eliminated without full nighttime shutdown. Complete, dusk to dawn, year-round shutdown is typically not feasible, as it could reduce power output to levels below that necessary to maintain economic feasibility and compliance with applicable PPA requirements of a project. Full nighttime shutdown is evaluated as an alternative in Section 8.1.

In 2010, barbed wire fences were the greatest known source of Hawaiian hoary bat fatalities (Zimpfer and Bonaccorso 2010). Annual mortality estimates range from zero to 0.8 Hawaiian hoary bats per 62 miles of barbed wire. It is believed Hawaiian hoary bats are more vulnerable to barbed wire fences that occur in open and forest edge areas than in heavily cluttered forested areas. Tree removal has the potential to impact juvenile bats because they may be unable to fly away from a tree when it is cut or disturbed; however, it is not known how much bat take occurs as a result of tree trimming and harvesting (DOFAW 2015). To address the threats posed by barbed wire and tree removal, several additional minimization measures are recommended by USFWS and DOFAW. Avoiding the use of barbed wire where possible when installing fencing or other such structures can reduce this source of mortality. USFWS recommends using smooth wire when replacing barbed wire fencing. Impacts to pups in roosting trees can be avoided or minimized by not removing trees during the pupping season.

The greatest unquantified threats to Hawaiian hoary bats are from habitat loss, fire, pesticides, reduction in prey, and predation (USFWS 1998, USFWS 2011). These threats may be widespread across the state, and can result in direct and indirect mortality, reduced reproductive success, and reduced distribution of the Hawaiian hoary bat. Finally, records from the mainland indicate that bats are susceptible to being trapped and drowned in troughs, tanks, and pools with steep sides (Boyle 2014, Taylor and Tuttle 2007, Taylor 2007).

Despite the status as endangered, the Hawaiian hoary bat appears to have a low risk of extinction. The bat was listed as endangered in 1970, largely based on a lack of information. Since the Hawaiian hoary bat was listed as endangered, the population has persisted without direct action taken to promote the survival of the species. At the time, USFWS assigned the Hawaiian hoary bat a "recovery priority number of 9, indicating a subspecies with a moderate degree of threat and a high potential for recovery" (USFWS 1998). The interim down-listing criteria is defined by the USFWS (USFWS 1998) as, "Hence, downlisting can occur when the population on Hawaii is determined to be stable or increasing for at least five consecutive years." The down-listing criteria outlined in the USFWS Hawaiian Hoary Bat Recovery Plan (USFWS 1998) was met with the publication of the five-year occupancy study from Hawaii island (Gorresen et al. 2013). When a species reaches it's down-listing criteria, it is an indication that the recovery goals for the species have been met, and the service considers changing the listing status such as from endangered to threatened.

Overview of Impacts Associated with Wind Energy in Hawai'i

Across the continental United States, the mainland hoary bat is one of the bat species most frequently killed by wind turbines, primarily during fall migration (Kunz et al. 2007, Arnett et al. 2008). Hawaiian hoary bats do not have long-distance migration movements which are characteristic of mainland hoary bats. As a result, Hawaiian hoary bats may be less susceptible to fatality at wind turbines than mainland hoary bats, because Hawaiian hoary bats tend to approach wind turbines less frequently than their more migratory mainland conspecifics (Gorresen et al. 2015). For the wind farms in Hawai'i with approved HCPs, post-construction mortality monitoring data from January 2006 through December 2017 indicate that 32 of 70 (45.7 percent) observed fatalities of Hawaiian hoary bats occurred in August and September, and at least one fatality occurred during each other month of the year (DOFAW 2018). However, the seasonal patterns in the fatalities are at least partially a result of the disproportionate number of observed Hawaiian hoary bat fatalities that have occurred at the Project on Maui and the Kawailoa Wind Farm on O'ahu. Overall, these data suggest the Hawaiian hoary bat is vulnerable to collision with wind turbines throughout the year, and that the temporal distribution of fatalities is likely dependent on multiple site-specific factors (e.g., the island where the project is located, habitat, elevation), and potentially the influx of newly volant young that may occur in August and September. Therefore, project-specific post-construction mortality monitoring data are the best predictor of seasonal patterns of future take, and the most informative when developing avoidance and minimization measures.

3.8.1.3 Occurrence in the Project Area

A variety of studies have documented the occurrences of the Hawaiian hoary bat on Maui as shown in Figure 3-4. The locations shown are a compiled list of bat detections, captures, or observations from three studies, observations from three wind farms or associated mitigation areas, and four incidental or other types of observations largely over the last 10 years. Four observations date back to 1970, as shown in Table 3-1. The locations where no bat detections were recorded are not shown, because the sampling effort differs between locations and the absence of detections does not mean an absence of bats (Gorresen et al. 2017). The detections on Maui are predominantly associated with accessible areas; thus, as more efforts are made to detect bats, they will likely be documented in additional locations across Maui.

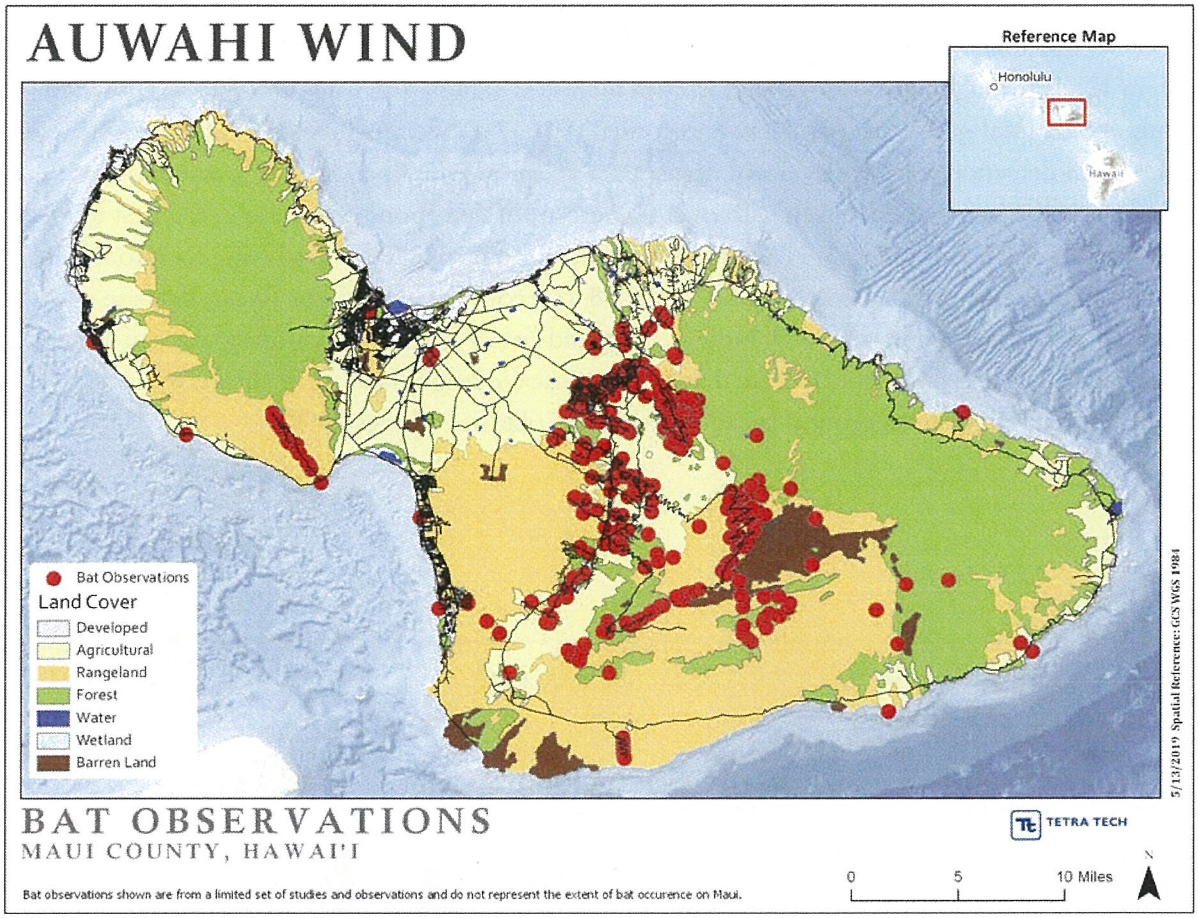


Figure 3-4. Documented Acoustic Bat Detections on Maui in Relation to Land Cover and Roads.

Table 3-1. Locations and Studies that Document Hawaiian Hoary Bat Observations on Maui as shown in Figure 3-2.

Location	Citation
Pu'u Kukui Preserve	DLNR 2005
Kahikinui Forest Reserve/Nakula Natural Area Reserve	Todd et al. 2016
Haleakalā National Park	Fraser et al. 2007
Auwahi Wind	Auwahi Wind 2017, Auwahi Wind 2018
Kaheawa Wind	KWP I 2017, KWP II 2017
Ulupalakua Ranch	Auwahi Wind 2017
Waikamoi	The Nature Conservancy 2011
Nu'u	Haleakalā National Park 2016
Olinda	Starr Environmental 2010
Kihei, Kahului, Lahaina, Leeward and Windward Haleakalā	USFWS 1998
West Haleakalā	H.T. Harvey and Associates 2019

Acoustic monitoring conducted at the Project using two ground-level acoustic monitors (Wildlife Acoustics SM2Bat+) placed at WTG 1 and WTG 6[4] from 2013 through 2015 documented low bat activity levels throughout most of the year, with increased activity August – October as shown in Figure 3-5. A total of 371 bat passes were recorded in 1632 detector nights (0.23 bat passes per night), with detections on 31 percent of nights over the monitoring period. The number of bat passes peaked 3 hours after sunset, with over 90 percent of detections occurring in the first 6 hours after dark, as shown in Figure 3-6 (Auwahi Wind 2015). Four nacelle-level acoustic monitors were placed at the Project at WTGs 2, 4, 5 and 7 in 2018 to record bat activity for 1 year; data are expected to be available in late 2019. Note that ground-based acoustic monitoring was not used as a proxy for risk at nacelle height because detections at nacelle height have been shown to be significantly different from ground-based detections (Collins and Jones 2009).

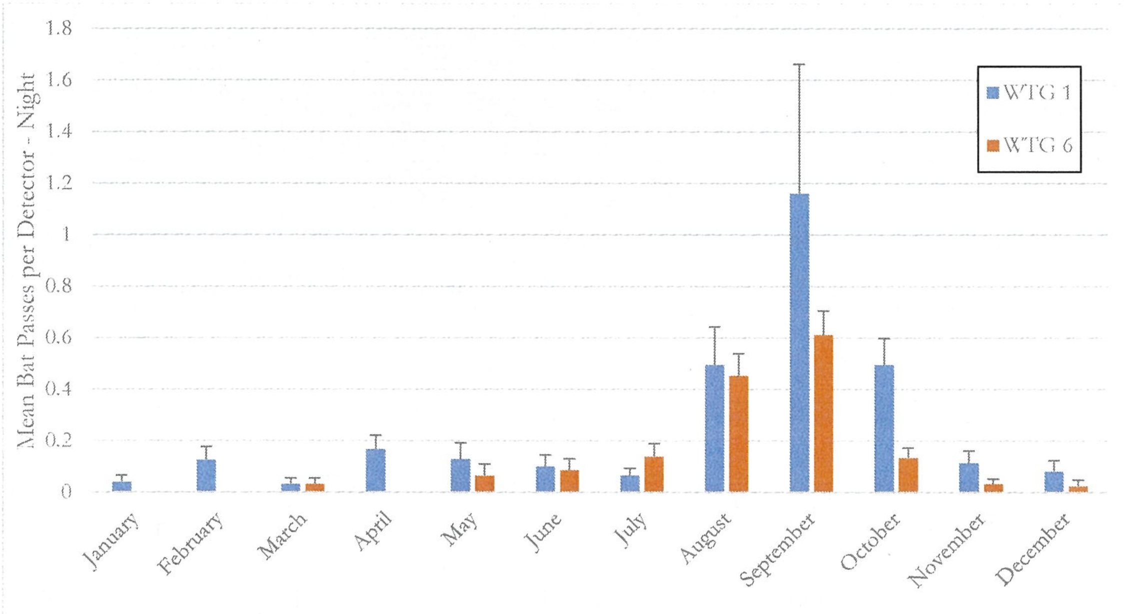


Figure 3-5. Acoustic data by month from ground detectors, 2013-2016.

[4] Turbines are numbered sequentially starting with the northernmost turbine being turbine 1, and the southernmost turbine being turbine 8.

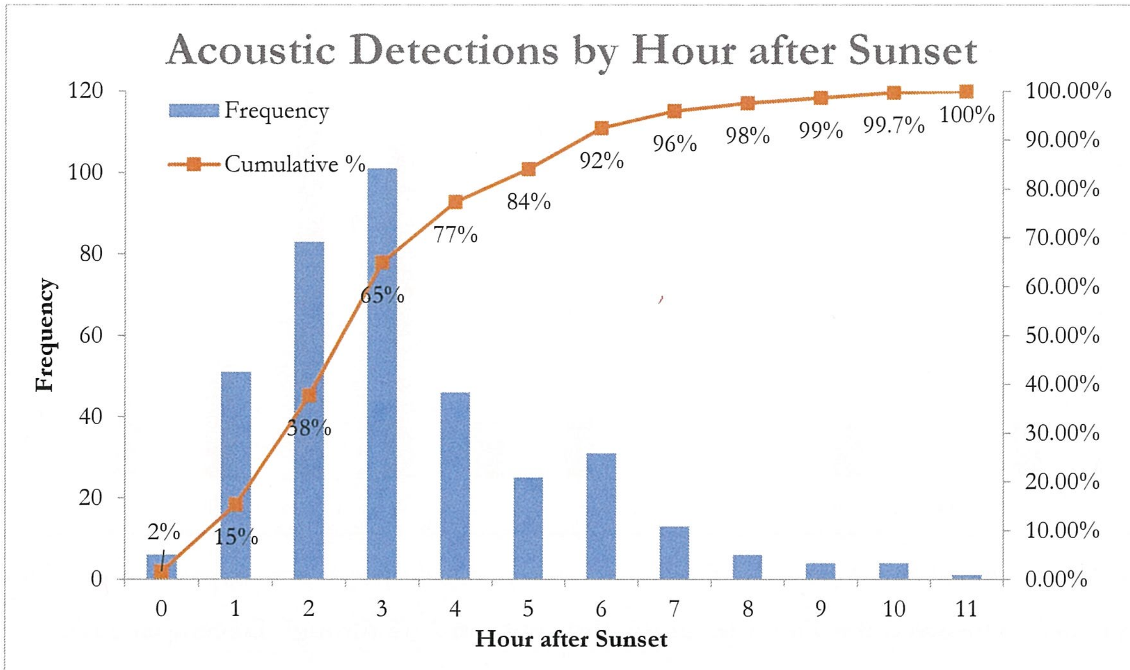
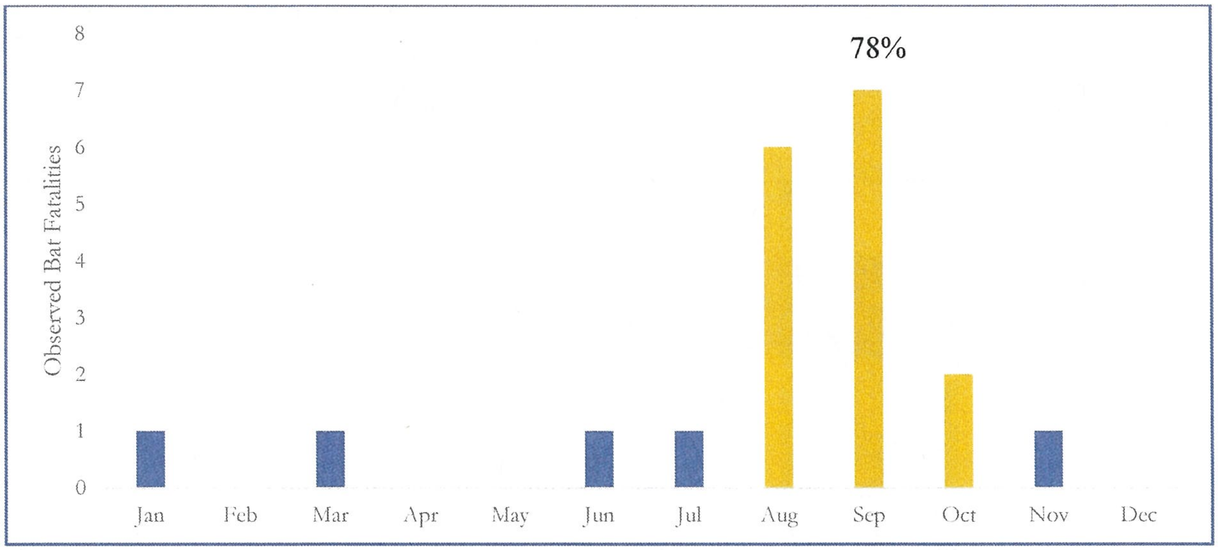


Figure 3-6. Acoustic data binned by hour after sunset from ground detectors, 2013-2016.

Post-construction mortality monitoring at the Project suggests a similar seasonal pattern in bat use based on the corresponding number of fatalities (Auwahi Wind 2013, Auwahi Wind 2014, Auwahi Wind 2015, Auwahi Wind 2016, Auwahi Wind 2017), as shown in Figure 3-7. As of December 31, 2017, 18 Hawaiian hoary bat fatalities have been documented; 16 of these fatalities were observed during post-construction mortality monitoring, and two were observed incidentally (outside search plot or regular search interval). Fourteen of the 18 observed fatalities (78 percent) occurred between August and October. Genetic determination of gender has been conducted by the U.S. Geological Survey (USGS) for 12 of the observed fatalities; their results indicate that approximately 50 percent of the fatalities were male and 50 percent female.



Note: Yellow bars indicate 78 percent of fatalities have occurred in the period from August through October.

Figure 3-7. Observed Bat Fatalities at the Project from 2013 through December 2017.

The variable timing of bat fatalities among the operational wind projects suggests that project-specific factors (e.g., topography or vegetation) influence bat fatality patterns. However, sample sizes are small, and no definitive conclusions can be drawn at the present time. The Project site is a relatively lowland location with elevations between 900 and 3,800 feet (Figure 1-2). Research from Hawai'i Island suggests that bats normally occupy higher elevations during the non-breeding season. Observation of fatalities during the non-breeding season suggest that there may also be island-specific factors that influence temporal trends in bat fatalities.

Based on observed fatalities at the Project, there may be inter-annual variability in Project take. During the first 3 years of monitoring (2013-2015), the number of observed bat fatalities per year was 1, 4, and 1, respectively. In 2016, seven bat fatalities were observed during systematic monitoring, despite the implementation of LWSC with a cut-in speed of 5.0 m/s, year-round. In 2017, three fatalities were observed during systematic monitoring. Overall detection probability estimated by EoA increased from 0.28 in year 1 to between 0.45 and 0.66 for all remaining years due to increases in search intensity and implementation of predator control. Average detection probability for all years of monitoring (2013-2017) is 0.5, with a standard deviation of 0.11, indicating that the number of observed fatalities per year is comparable among years. Appendix H contains more detailed information on the detection probability and estimation process. The causes of any inter-annual variability are unknown. Anecdotal data from 2016 suggest that causes of inter-annual variability may include anomalous weather patterns, drought cycles, or other phenomena. The average number of observed fatalities over the 5 years of monitoring is 3.2 observed fatalities per year. Therefore, 2017 represents a return to the average value.

For the Project, average monthly wind speeds recorded from dusk to dawn between years 2014 - 2018 ranged from 6.25 to 9.18 meters per second as seen in Figure 3-8. No correlation was found between fatalities and the wind regime at the site; average wind conditions during the three months (August through October) of highest bat fatalities at the Project were not lower than other months of the year. The lowest average wind speeds occurred in the months of January and February. For months with few observed fatalities, the risk to Hawaiian hoary bats is minimal, suggesting that additional wind turbine curtailment in these periods would not significantly reduce collision risk.

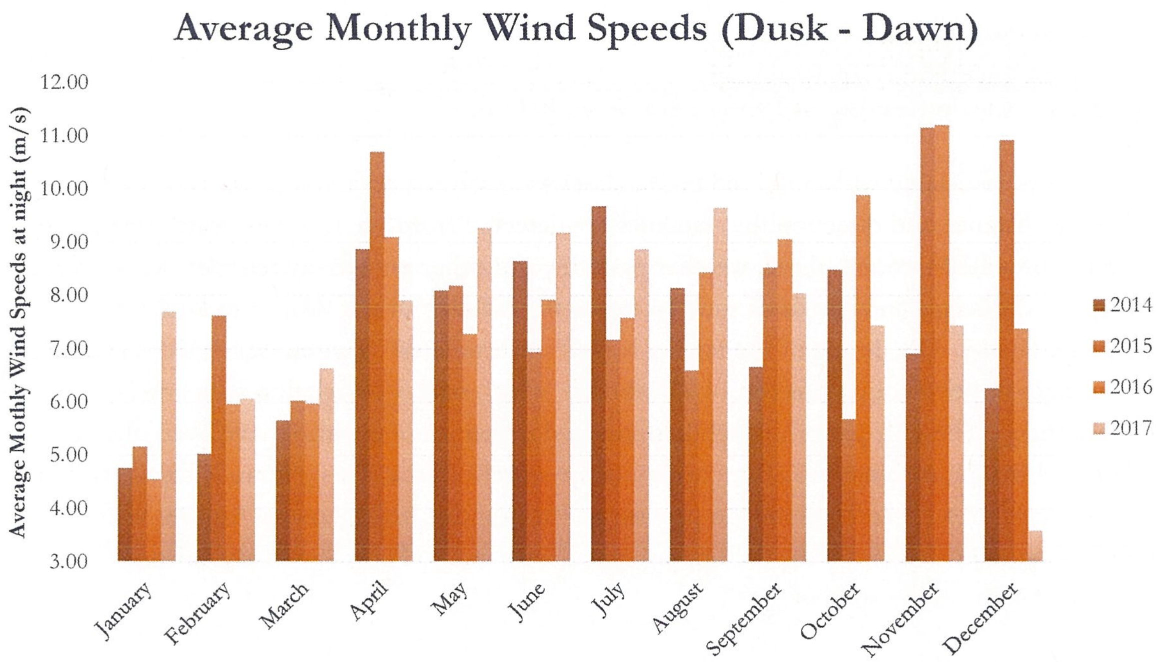


Figure 3-8. Wind Regime from Dusk to Dawn at Project Site from 2014-2017.

Another factor analyzed to help assess any potential patterns of observed bat fatalities was whether cattle were grazing in the Project area around the time of the reported bat fatalities. As illustrated by Figure 3-9, approximately 28 percent of observed fatalities have coincided with the grazing and 30-day post grazing period. The 30-day post grazing period accounts for insect abundance associated with cattle dung after the cattle have been removed.

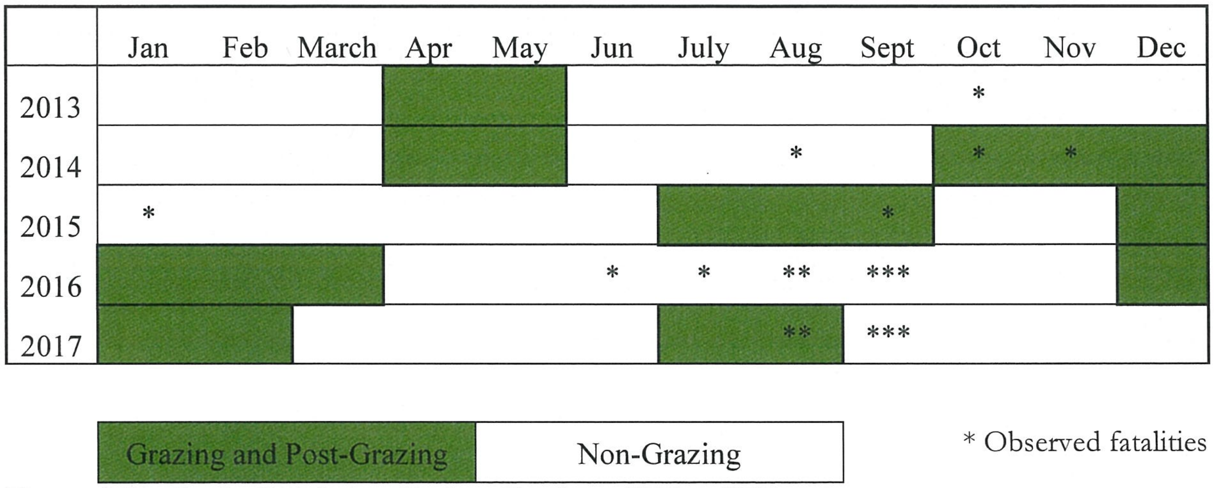


Figure 3-9. Cattle Grazing at Project Site from 2013 to 2017.

Other factors associated with observed bat fatalities are analyzed on an ongoing basis. These factors include the distance and direction that fatalities are detected from the turbines, wind speed, wind direction, rotor RPM, moon phase, weather patterns, and other potentially relevant factors. One of the primary challenges in analysis of such factors is the inability of the Project to know the exact timing of a fatality. The timing of the fatality is typically estimated to within seven days, meaning a large number of prior conditions must be evaluated, which makes correlation with any factor or factors difficult. The only pattern which has emerged is that more fatalities have been observed at turbines 1-4 than at turbines 5-8 after correcting for searched area. This pattern is discussed in more detail in Section 7.4.1.3 and included in provisions for adaptive management. Auwahi Wind is conducting studies to identify the factors associated with risk to Hawaiian hoary bats; see Section 7.4.1.2 for details on the studies.

3.8.2 Hawaiian Petrel

This section requires no edits for the HCP Amendment.

3.8.3 Nene

This section requires no edits for the HCP Amendment.

3.8.4 Blackburn's Sphinx Moth

This section requires no edits for the HCP Amendment.

3.9 OTHER RESOURCES

This section requires no edits for the HCP Amendment.

4.0 GOALS AND CONSERVATION MEASURES

This section requires no edits for the HCP Amendment except as provided in the subsections below.

4.1 BIOLOGICAL GOALS AND OBJECTIVES

In addition to the biological goals and objectives of the approved HCP, the following provides biological goals and objectives for the HCP Amendment for the Hawaiian hoary bat.

4.1.1 Goals

Biological goals are intended to be broad, guiding principles that clarify the purpose and direction of the HCP (USFWS and NMFS 2016). The biological goals for the HCP Amendment are:

- Minimize impacts to the Hawaiian hoary bat to the maximum extent practicable in the Project area; and
- Mitigate remaining impacts to fully offset impacts and provide a net benefit to the Hawaiian hoary bat by protecting, enhancing and/or managing Hawaiian hoary bat foraging and/or roosting habitat.

4.1.2 Objectives

Biological objectives are derived from the goals and provide the basis for determining strategies, monitoring effectiveness and evaluating the success of actions (USFWS and NMFS 2016). The biological objectives for achieving the HCP Amendment goals are:

- Implement strategic minimization measures, and as needed, additional minimization actions at defined time periods according to a clear adaptive management plan, to reduce Hawaiian hoary bat take and ensure total permitted take is not exceeded for the remainder of the permit term; and
- Implement a mitigation project or projects that will protect, manage and/or enhance Hawaiian hoary bat habitat on Maui or within Maui Nui to promote foraging, roosting, and/or breeding habitat through the removal of threats or the addition of features necessary for those stages of the Hawaiian hoary bat life cycle.

Avoidance, minimization, and mitigation measures that will be used to achieve these goals and objectives, and the measures of success are described in detail in the subsequent sections of this HCP Amendment.

4.2 AVOIDANCE AND MINIMIZATION OF IMPACTS

This section requires no edits for the HCP Amendment.

4.2.1 General Project Development Measures

This section requires no edits for the HCP Amendment.

4.2.2 Pre-construction Surveys and Timing Considerations

This section requires no edits for the HCP Amendment.

4.2.3 Project Components and Siting Considerations

This section requires no edits for the HCP Amendment.

4.2.4 Invasive Plant Species Management

This section requires no edits for the HCP Amendment.

4.2.5 Fire Prevention During Construction and Operation

This section requires no edits for the HCP Amendment.

4.2.6 Measures to Minimize Environmental Impacts

This section requires no edits for the HCP Amendment.

4.2.7 Operational Avoidance and Minimization Measures for the HCP Amendment (New HCP Amendment Section)

Auwahi Wind is committed to reducing the risk of bat fatalities at the Project. Auwahi Wind considered the current literature from the mainland and recommendations in the ESRC Bat Guidance (DOFAW 2015) for identifying appropriate minimization measures for bats. LWSC is considered the best measure at this time to minimize impacts to bats while taking into consideration site-specific wind conditions and Project-specific energy generation or PPA requirements.

LWSC, as noted in Section 3.8.1.2, has been demonstrated to show a statistically significant reduction in bat fatalities. Based on current turbine technology, initiation of LWSC is determined by a 10-minute running average of wind speeds collected at the turbine nacelle. During curtailment, blades are feathered, reducing the speed of the blade to less than one RPM. Turbines take approximately 10 seconds to reach this rate of rotation when curtailment is initiated, and approximately 90 seconds to leave curtailment mode (depending on wind speeds, wind farm power output, and voltage/frequency requirements).

In response to the Project post-construction mortality monitoring results, Auwahi Wind began experimenting with LWSC regimes as adaptive management minimization measures to reduce impacts to the Hawaiian hoary bat, starting in late 2014. These measures are described below:

- Between November 2014 and January 2015, Auwahi Wind voluntarily implemented an operational protocol under which turbine blades were feathered below the manufacturer's recommended cut-in wind speed of 3.5 m/s, from at least 1 hour before sunset to at least 1 hour after sunrise.
- Beginning in February 2015, Auwahi Wind initiated voluntary year-round curtailment by feathering turbine blades at wind speeds below 5.0 m/s, from at least 30 minutes before sunset to at least 30 minutes after sunrise.

However, in 2017 when bat take was projected to exceed the ITP/ITL authorized take limit, Auwahi Wind reviewed and updated the analysis of the best available information from the mainland to identify alternative LWSC regimes that could further reduce risk to bats. The primary means of increasing the effect of LWSC on potential impacts to bats is to increase the wind speed at which turbines return to service. As summarized in Table 4-1, estimates of the impact of LWSC regimes from studies on the mainland suggest a reduction in bat take ranging from 10 to 92 percent. Figure 4-1, below, applies a best fit regression analysis of percent reduction in bat fatalities for a given cut-in speed, as depicted by the dotted line. The analysis shows that above a certain point, increases in cut-in speed do not result in commensurate further increases in fatality reductions. For example, there is less than a 0.3 percent reduction in bat fatalities above cut-in speeds of 6.9 m/s. Although there is a theoretical maximum reduction of bat fatalities from the regression, extrapolation from such a dataset should be done with caution because there are numerous variables (e.g., site, wind regime, bat abundance, bat species) in addition to the LWSC, which may contribute to variation in bat fatality rates between sites, or treatments. Thus, the regression analysis predicts that increasing cut-in speeds above 6.9 m/s provides insignificant increases in risk reduction, making a LWSC regime of 6.9 m/s the maximum extent practicable for cut-in speed, based on the literature review. A summary of current literature on the effectiveness of LWSC is provided in Appendix G.

The regression analysis in Figure 4-1 indicates that a LWSC cut-in speed of 6.9 m/s should reduce the risk of bats fatalities by 76 percent. Similarly, a Technical Assistance Letter from the USFWS in response to the Draft Headwaters HCP, and Pioneer Trail Bird and Bat Conservation Strategy suggests that a LWSC cut-in speed of 6.9 m/s is sufficient avoidance that take of Indiana bats (*Myotis sodalis*) would not be expected (Headwaters Wind Farm 2018, Stantec 2015). Increases in LWSC cut-in speed beyond 6.9 m/s are not anticipated to have a significant impact on the risk to bats. Studies looking at the impacts of LWSC have used 6.9 m/s as the maximum cut-in speed; at this time there are no publicly available studies looking at higher cut-in speeds.

Observations of bat fatalities at the Project vary seasonally and post-construction mortality monitoring implemented by Auwahi Wind indicates that 78 percent (14 of 18) of observed fatalities at the Project have occurred in the months of August to October. Therefore, this timeframe (August 1 through October 31) was selected as the period of highest risk at the Project, and the period to prioritize for maximum risk reduction effort (i.e., most aggressive LWSC regime). As derived from the regression in Figure 4-1 and using a percent reduction in bat fatalities of 76 percent (based on implementing LWSC at 6.9 m/s year-round), applying LWSC at 6.9 m/s during the 3-month period of maximum risk (representing 78 percent of the observed take) results in an estimated 59 percent (76% x 78% = 59%) reduction in take rate.

The other key element of a LWSC regime is seasonal application of selected cut-in speeds. Seasonal adjustment of cut-in-speeds has been used at wind facilities on the mainland to minimize impacts to listed bat species such as Indiana bats and northern long-eared bats (*Myotis septentrionalis*). For example, some wind facilities will raise the cut-in speed to 5.0 m/s during the fall migration period (August 1 to October 15) or consider other seasonal adjustments as part of an adaptive management program (Stantec 2015). USFWS had deemed these appropriate avoidance and minimization measures for these listed bat species (WEST 2013, Stantec 2016). Although there is not a traditional migratory pattern in Hawai'i for Hawaiian hoary bats, there are seasonal movements that have been documented in the literature, acoustic data, and observed fatalities (Todd 2012, Bonaccorso et al. 2015, Kawailoa Wind Power 2017, Auwahi Wind 2015). From data observed at the Project and some other wind projects in Hawai'i, there generally appears to be a greater risk to bats in the months from June to November. At the Project, 5 years of post-construction mortality monitoring (2013-2017) indicates that 78 percent of observed fatalities have occurred in the months of August to October.

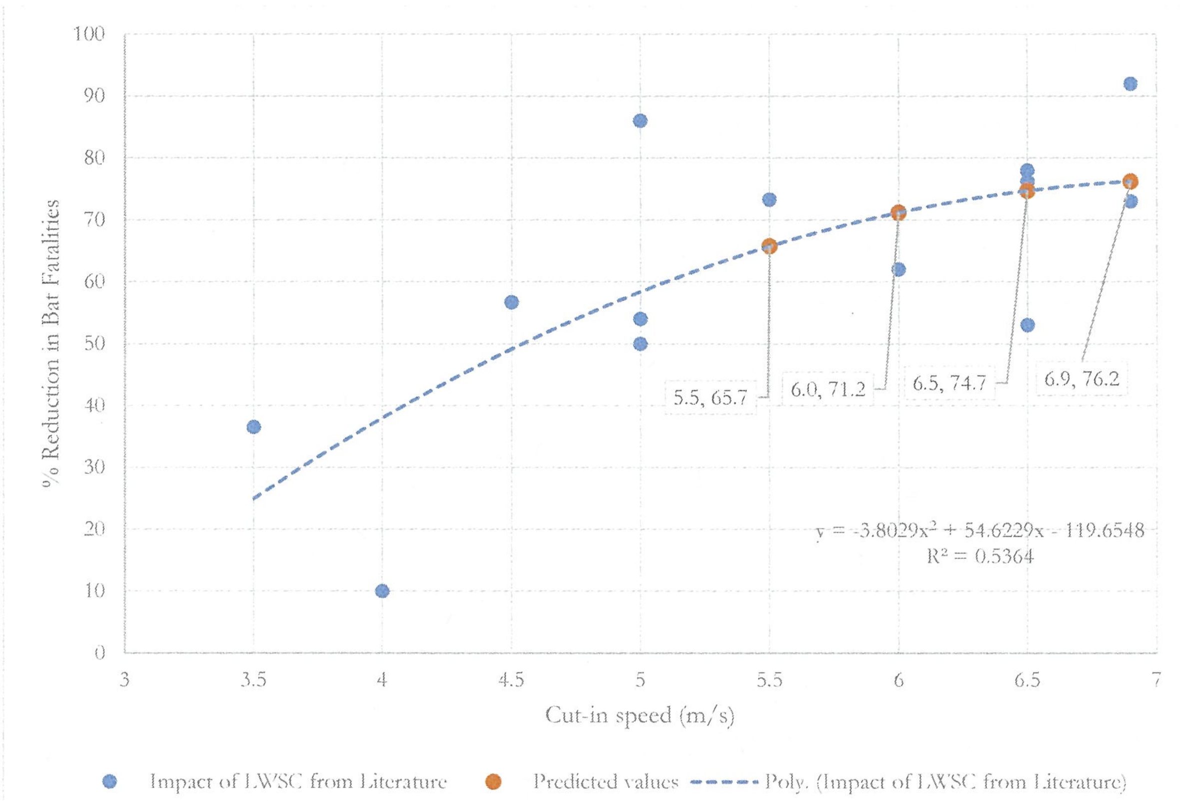


Figure 4-1. Synthesis of Low Wind Speed Curtailment Impact on Bat Fatalities

Table 4-1. Regression Analysis Data Used to Synthesize LWSC Impact on Bat Fatalities in Figure 4-1

Normal Cut-In Speed (m/s)	Treatment (m/s)	Percent Reduction (%)	Facility and Location	Analysis from Multi-species of Bats	Hoary Bats Included in Analysis	References
3.5	6.9	92	Laurel Mountain Wind Energy Project WV	Yes	Yes	Stantec 2015
3	5	54	Pinnacle Wind, WV	Yes	Yes	Hein et al. 2014
3	6.5	76.2	Pinnacle Wind, WV	Yes	Yes	Hein et al. 2014
4	6	62	Sheffield Wind Facility, VT	Yes	Yes	Martin et al. 2017
NA	6.9	73	Beech Ridge, WV	Yes	Yes	Tidhar et al. 2013
0	3.5	36.5	Fowler Ridge, IN	Yes	Yes	Good et al. 2012
0	4.5	56.7	Fowler Ridge, IN	Yes	Yes	Good et al. 2012
0	5.5	73.3	Fowler Ridge, IN	Yes	Yes	Good et al. 2012
0	4	10	Mount Storm, WV	Yes	Yes	Young et al. 2012
3.5	5	50	Fowler Ridge, IN	Yes	Yes	Good et al. 2011
3.5	6.5	78	Fowler Ridge, IN	Yes	Yes	Good et al. 2011
0	5	86	Casselman, PA	Yes	Yes	Arnett et al. 2011
0	6.5	53	Casselman, PA	Yes	Yes	Arnett et al. 2011

To have a likelihood Hawaiian hoary bat take, bats must be present at the wind farm while turbines are operating. Auwahi Wind developed its LWSC program to incorporate a seasonal approach, focusing on the periods of greatest risk to the bats at Auwahi to minimize impacts of incidental take to the maximum extent practicable. Auwahi Wind determined that it can implement a LWSC regime of 6.9 m/s during the 3 months (August through October) of highest bat fatalities at the Project based on the 5 years of post-construction monitoring (described below in more detail) and apply a LWSC regime of 5.0 m/s the remainder of months (November through July) when risk is lower. Auwahi Wind evaluated pertinent data on the months in which risk to bats is low. From the start of operation through December 2017, no fatalities were observed in the months of February through May, and December. One fatality was found in each of the months January, June, July, and November. The period of highest risk for bat fatalities at wind energy facilities tends to occur during relatively low-wind conditions (Arnett et al. 2008).

Auwahi Wind implemented the following as initial minimization measures starting in 2018 and will continue to do so for the duration of the permit, unless specific adaptive management triggers are reached that would initiate an adaptive management action. These minimization measures are:

- Implement LWSC for all eight turbines with a 5.0 m/s cut-in speed November through July (all months without LWSC at higher cut-in speeds), from 30 minutes before sunset to 30 minutes after sunrise; and
- Implement increased nighttime LWSC with a 6.9 m/s cut-in speed for all eight turbines, from 30 minutes before sunset to 30 minutes after sunrise, for the months of August to October (that is, the period for which data from the first 5 years of operation show that most bat fatalities have occurred).

Adaptive management of this operational avoidance and minimization strategy is discussed in Section 7.4.1. Alternative minimization strategies considered but not implemented are discussed in more detail in Section 8.

5.0 ASSESSMENT OF POTENTIAL IMPACTS AND TAKE LIMITS

Estimates of direct take and indirect take collectively inform the amount of additional take requested under this HCP Amendment (Section 5.1.3). Due to the uncertainty related to estimating take over the long term, the approved HCP developed a tiered approach for structuring requested take and associated mitigation. Under this HCP Amendment, three additional tiers of Hawaiian hoary bat take (Tiers 4 – 6) have been added to the three approved tiers. Tier structuring and triggers for initiating mitigation are described in detail in Section 5.1.3 and Section 6.2.5, respectively. The estimated take of other Covered Species has not been revised from the information presented in Sections 5.2 through 5.4 of the approved HCP.

5.1 HAWAIIAN HOARY BAT

Impacts to Hawaiian hoary bats associated with wind farm operation are described in Section 5.1 of the approved HCP. Collision risk has been verified through the results of post-construction mortality monitoring programs that have been implemented at the five Hawai'i wind farms that possess approved HCPs, including data collected since 2012 at the Project (see Section 3.8.1.3 for a summary of take observed through December 31, 2017). Despite the implementation of avoidance and minimization measures such as LWSC, the data show that at KWP II, Kawailoa Wind, and at the Project, the initially authorized ITP/ITL take limits have been exceeded. As a result, each of these wind farms are in the process of amending their HCPs to provide ITP/ITL coverage for additional bat take. KWP I and Kahuku wind farms are implementing their HCPs without requesting amendments.

Project-specific monitoring data were used in this HCP Amendment to predict take over the assumed 20-year operational period of the Project (December 2012 – 2032), consistent with the Project's current PPA. As noted in Section 2.2, the term of the ITP/ITL is 25 years (through 2037), which includes five years during which Auwahi Wind may consider extending the operational life of the Project through a new or revised PPA. Assuming the authorized take limits have not been reached, legal coverage under the ITP/ITL would remain in effect during this period.

5.1.1 Direct Take for the HCP Amendment

For this HCP Amendment, Auwahi Wind used the number of observed fatalities and monitoring detection bias (detection probability) from five complete years (2013 – 2017) of Project-specific post-construction mortality monitoring to predict future direct take. Search interval, searched area, carcass persistence, and searcher efficiency are used to inform the detection probability. Detection probability is used to adjust the number of observed fatalities to account for unobserved take. The projection of future take therefore accounts for uncertainty in the detection of carcasses, and the projection provides an estimate of take over the remaining years of the permit term.

To predict direct take over the 20-year operating life of the Project, the multi-year analysis module in the current EoA software (version 2.0, Dalthorp et al. 2017) was used to incorporate the post-construction mortality monitoring data collected through December 2017. The EoA software is the state-of-the-art analysis tool currently being employed by USFWS and DOFAW to evaluate compliance with the ITP/ITL, and therefore is currently the most appropriate tool for predicting direct take. Input parameters are provided in Table 5-1. An underlying assumption for this analysis is that detection probability and fatality rates derived from post-construction mortality monitoring are representative of future years. Using the current USFWS and DOFAW ITP/ITL compliance standard, the 80 percent upper credible limit value output from EoA is assumed to represent the credible maximum number of fatalities that could occur over the life of the Project. Using data from Project monitoring through December 31, 2017 it can be asserted with 80 percent certainty that Project-related direct take through 2017 does not exceed 38 bats. Using the same data to predict future take, the EoA model predicts a total direct take of 162 bats through the remainder of the ITP/ITL term if no additional minimization measures are implemented (i.e., baseline).

As described in Section 4.2.7, Auwahi Wind estimates that curtailment with a cut-in speed of 6.9 m/s for the months of August to October will reduce the fatality rate by 59 percent. However, there is uncertainty in extrapolating the effectiveness of LWSC in reducing bat fatalities from mainland studies on several bat species to the effectiveness of LWSC on the Hawaiian hoary bat. Data on the effectiveness of LWSC on bats in Hawai'i are lacking due to the relatively low number of fatalities (insufficient sample size precluding statistical analysis) or because some wind farms have implemented LWSC since the start of commercial operation, precluding a before/after comparison. The actual reduction in take rate at the Project may vary (higher or lower) from the modeled data.

To account for the uncertainty in the effectiveness of LWSC in reducing the risk to Hawaiian hoary bats, Auwahi Wind conservatively assumed a minimum 30 percent reduction of future direct take. The baseline EoA model was then modified to account for a minimum 30 percent reduction in future direct take by implementing this LWSC regime. As shown in Table 5-1, and based on assumptions described here, it can be asserted with 80 percent certainty that total Project-related direct take through 2032 will be no more than 129 bats with implementation of this LWSC regimen. This updated direct take estimate reflects only a reduction in take for future years, not an overall reduction of 30 percent from 162 bats. See Appendix H for additional detail on the take estimate and EoA software, including an explanation of the analysis periods and relative weights. This take estimate represents the highest level of direct take that would be anticipated given the monitoring data through December 2017. Considering the conservative 30 percent reduction of take applied due to minimization measures, the actual direct take will likely be lower than the 129 bats predicted.

Table 5-1. Predicting Bat Take: Model Input Parameters for EoA Multi-Year Analysis Based on 5 Years of Project Monitoring

Analysis Period Dates	Number of Fatalities Observed[1]	Detection Probability ($\hat{g}$)[2]	$\hat{g}$ Lower	$\hat{g}$ Upper	Relative Weight[2]	Basis for Values
January–December 2013	1	0.282	0.216	0.352	12	Post-construction mortality monitoring data January – December 2013
January 2014 – January 2015	4	0.548	0.445	0.648	13	Post-construction mortality monitoring data January 2014 – January 2015
February – December 2015	1	0.451	0.378	0.525	11	Post-construction mortality monitoring data February – December 2015, Period begins with implementation of LWSC at 5.0 m/s cut in speed.
January–December 2016	7	0.549	0.463	0.634	12	Post-construction mortality monitoring data January – December 2016
January –March 2017	0	0.668	0.592	0.74	3	Post-construction mortality monitoring data January – March 2017, Period ends with the end of the 3-day search interval
March – December 2017	3	0.58	0.479	0.677	9	Post-construction mortality monitoring data March – December 2017, 4-day search interval
January 2018 – December 2032	NA[3]	0.571	0.485	0.652	8.4 [3]	Estimated based on post-construction mortality monitoring data using canine search teams, minimum reduction (30 percent) in future fatalities expected for implementation of additional minimization measures (12 months * 70% = 8.4 relative weight)

1. Observed take counts only those fatalities observed in systematic monitoring. Carcasses found incidentally are accounted for through EoA modelling.

2. Detection probability and relative weights are inputs into the EoA software for projecting total Project Hawaiian hoary bat take over the permit term. Relative weights are months used in analysis.

3. Years over which take predicted; observed fatalities yet to be determined.

5.1.2 Indirect Take for the HCP Amendment

The direct take of an adult female bat during the time when young are dependent on her may result in the indirect loss or take of dependent offspring. The following variables used to predict the magnitude of this indirect take are based on parameters recommended in USFWS and DOFAW guidance (USFWS 2016a):

- A conservative estimate of direct take (Section 5.1.1);
- The proportion of take assumed to be adult females (only female bats care for young);
- The proportion of fatalities occurring during the period when young bats are dependent;
- The probability that the loss of a reproductively active female results in the loss of her offspring;
- The average reproductive success rate; and
- The proportion of young that survive to reproductive age.

The rationale and values used to predict indirect take are outlined in Table 5-2 and result in an indirect take prediction of 11 adult-equivalent bats during 20 years of operation. Because current mitigation frameworks only provide guidance relative to adult bats, indirect take was adjusted to bats (adults) by multiplying the predicted number of indirectly taken juveniles by the probability those juveniles would survive to become adults (Table 5-2, Line Numbers 2 through 5).

Table 5-2. Indirect Take Estimate Derived for Hawaiian Hoary Bat, Combined with the New Estimated Future Direct Take (observed and unobserved) for the HCP Amendment

Line Number	Component	Calculation of Count	Number of Bats	Calculation of Indirect Take[1]	Indirect Take Assessment
1	Observed[2] male fatalities, or observed fatalities outside the breeding season	Observed	8	No impact to dependent young, multiply by 0	0
2	Observed[2] female fatalities within the breeding season	Observed	2	Multiply by estimated reproductive rate 1.8 * proportion of offspring surviving to adulthood 0.3	1.08
3	Observed[2] fatalities of unknown sex within the breeding season	Observed	6	Multiply by proportion of population assumed to be female 0.5 * estimated reproductive rate 1.8 * proportion of offspring surviving to adulthood 0.3	1.62
4	Unobserved fatalities	38 estimated at 80% CI using EoA[3] minus 16 observed	22	Multiply by proportion of the population assumed to be taken with dependent young 0.25 * proportion of population assumed to be female 0.5 * estimated reproductive rate 1.8 * proportion of offspring surviving to adulthood 0.3	1.49
5[4]	Future direct take (unobserved)	129 predicted at the 80% CI using EoA[3] minus 38 current take estimated at the 80% CI	91	Multiply by proportion of the population assumed to be taken with dependent young 0.25 * proportion of population assumed to be female 0.5 * estimated reproductive rate 1.8 * proportion of offspring surviving to adulthood 0.3	6.14
6	**Future Indirect take**	Sum the indirect take assessment for line numbers 1-5, rounded up to the nearest whole number	11	Sum the indirect take assessment for line numbers 1-5, rounded up to the nearest whole number	11
7	**Total take estimated at the 80% CI**	Sum the count for line numbers 1-6	**140[5]**		

1. Calculations based on USFWS Wildlife agency guidance for calculation of Hawaiian hoary bat indirect take, unless otherwise noted.
2. Observed take counts only those fatalities observed during systematic monitoring. Carcasses found incidentally are accounted for through EoA modelling.
3. Dalthorp et al. 2017.
4. Calculations of future indirect take are based on USFWS guidance and actual estimates of indirect take will depend on the timing and gender of observed fatalities.
5. The total take estimate includes 21 bats authorized under the approved HCP and 119 additional bats requested in the HCP Amendment.

5.1.3 Authorized Take Request for the ITP/ITL for the HCP Amendment

Based on the estimates of direct and indirect take discussed in Sections 5.1.1 and 5.1.2, respectively, the total take authorization for the Project would be 140 bats (129 direct and 11 indirect) under the HCP Amendment. This take amount consists of the 21 adult bats currently authorized under the approved ITP/ITL[5], and the additional authorized take of 119 bats requested through this HCP Amendment (Table 5-2). This requested take is based on several conservative assumptions such as the effectiveness of minimization measures; thus, the actual take that could occur may be lower than what is being requested. The assumptions or uncertainties that inform the conservative take request include the following:

- USFWS and DOFAW have recommended the 80 percent credible level be used when interpreting the results of the fatality data when using the EoA model which often inflates the fatality estimate.
- The prediction of future years of take relies on past data and incorporates uncertainty for future years which inflates the take estimate.
- The effectiveness of the minimization measures is uncertain; therefore, Auwahi Wind has chosen a conservative stance in predicting that the LWSC program will be 30 percent effective in reducing the overall number of fatalities. The best available information suggests that actual effectiveness may range between 59 percent and 76 percent, based on studies performed on the mainland.
- The take will occur slowly over time, as the highest take rate predicted in the HCP Amendment is 7 bats per year. This provides the opportunity for additional advancements in the development of new minimization measures as outlined in Section 7.4.

These factors combine to maximize the likelihood that the total take request will not be exceeded over the remaining permit term and the actual take will likely be less than the proposed amended take limit. Nonetheless, Auwahi Wind is committed to mitigate for the take requested.

The calculation of take for compliance with authorized take limits established under the ITP/ITL will use methods described in the long-term post-construction monitoring plan (Appendix E). To provide confidence that mitigation will precede or be concurrent with take, clear triggers and timing for the initiation of planning and implementation of mitigation in subsequent tiers are detailed in Section 6.2.

5.1.3.1 Potential for Population-Level Impacts

The potential Project impacts on the Hawaiian hoary bat can be assessed in relation to several of the bats' life history parameters including distribution, population size and resilience. As discussed in

[5] Per agreement with USFWS and DOFAW and biological assumptions presented in the approved HCP, 19 adults and 8 young permitted under the approved HCP were converted to 21 bats based on an assumed survival rate of juveniles to adulthood of 0.3 (Email correspondence with USFWS on April 28, 2015).

Section 3.8.1, the bat has a broad distribution across Maui that suggests the Project would only impact a small subset of the larger population on Maui. Since these bats have been documented to fly up to 7 miles in a night, the area of Maui within flight distance of the Project is approximately 11.7 percent of the island. Because the Hawaiian hoary bat has been shown to have strong fidelity to their respective roost trees (Bonaccorso 2010), this suggests that the scope of impacts would be limited. It would be improbable for all bats on Maui to traverse the Project area, and of those that do, not all would be impacted.

Additionally, the Project impacts on the Hawaiian hoary bat can also be analyzed in relation to the species' population size and resilience. The maximum estimated Project take is 6.45 bats per year over the life of the Project; but given the additional minimization measures outlined in Section 4.2.7, the total take is likely to be less than the maximum. The Maui population is estimated to be between 1400 and 5200 individuals (see Section 3.8.1), with maximum Project impact estimated to fall at 0.5 percent (or less) per year if considering the low end of the population estimate. Therefore, multiple layers of conservatism in favor of the species are built into these estimates (e.g., proportion of the island utilized by the bat, percent of land occupied, and fatality estimation), and given the low proportion of the estimated population impacted, it would be unlikely for the Project to have a significant negative impact on the Hawaiian hoary bat population of Maui.

While the impacts to the Maui population are likely to be low, the impacts of mitigation will provide a net benefit to the species. Auwahi Wind's land-based mitigation at Pu'u Makua has achieved its interim success criteria, and should continue to provide a benefit to the Hawaiian hoary bat (Auwahi Wind 2017). In addition, biological research being conducted for mitigation under Tiers 2 – 3 will contribute to filling in knowledge gaps that will lead to more effective on-the-ground management activities for the species. Additional mitigation for all Project-related take will be implemented on Maui (Sections 6.2.4 and 6.2.5) and will contribute to the species' recovery. The mitigation for Tier 4 will improve foraging habitat equivalent to 86 CUAs, exceeding the take request for Tier 4 (60 bats). Beyond the CUA analysis, bats have been shown to have overlapping foraging ranges and many more bats may benefit from the mitigation conducted than what is described in Section 6.2.4. Additionally, the habitat will last for multiple generations and outlast the permit term, and thereby providing further benefit for the species.

Notably absent from the life history traits and ecology of the Hawaiian hoary bat are factors associated with a declining population. Such factors may include:

- Low fecundity, such that the population of young does not replace adults lost to mortality[6];
- Significant loss of suitable habitat;
- Habitat specialization;

[6] The assessment of fecundity is based on the USFWS Recovery Plan and agency guidance on the calculation of indirect take (USFWS 1998 and USFWS and DOFAW 2016).

- Emigration, which is thought to be rare for Hawaiian hoary bats;
- Disease, which has not been documented in Hawaiian hoary bats; and
- Loss of food availability, which is unlikely for a prey generalist.

The Hawaiian hoary bat also has no known predators on Maui (Speakman 1995). A meta-analysis of risk factors identified large body size and limited geographic range or habitat specialization as being the strongest predictors of extinction risk (Chichorro et al. 2018). Small body size was noted to be a proxy for high fecundity and other life history traits, which are associated with a decrease in risk of extinction. Although the Hawaiian hoary bat is limited to occurrence in the Hawaiian Islands, "the mobility offered by flight renders virtually all the island from coastal embayments (Tomich 1986 and authors' personal observations) to the upper slopes of the highest mountains of Hawai`i accessible to foraging opportunities for Hawaiian hoary bats." (Gorresen et al. 2013). Data from the NOAA Coastal Change Analysis Program (CCAP) suggests the available habitat for Hawaiian hoary bat has not had a rapid decline and is unlikely to change substantially in the foreseeable future. CCAP data for Maui indicates a net increase in impervious surface of only 0.38 percent (to 3.45 percent in 2011), and a loss of forest cover of only 0.21 percent (to 32.2 percent in 2011) from 2005 to 2011, suggesting no substantial change to the available habitat over the period. This trend is an indication that the carrying capacity of the island is unlikely to undergo a rapid change due to development. The high fecundity, ability to utilize varied and spatially distributed resources, and documented distribution of the Hawaiian hoary bat suggest it is at low risk of extinction.

Recent genetic evidence suggests there have been significant inter-island dispersal events (Russell et al. 2015), but no conclusion was reached. The populations of individual islands are generally considered distinct (Baird et al. 2017). If the population of Hawaiian hoary bats on Maui is distinct, this suggests that impacts on Maui are unlikely to impact the population of other islands.

The best available information indicates that the Maui Hawaiian hoary bat population is widespread and abundant. No published or reported information suggests that either the Maui or statewide population is decreasing. Based on the best scientific data currently available, the Project is unlikely to cause adverse impacts to the species' overall population or recovery potential.

5.1.3.2 Cumulative Effects Associated with the HCP Amendment

Cumulative impacts relate to the impacts of the increased take associated with the HCP Amendment when considered in the context of past, present, and reasonably anticipated future actions that will also have an impact on the Hawaiian hoary bat population statewide and on Maui. On Maui, past development and other land use changes have resulted in the presumed loss of bat roosting and foraging habitat through the conversion of forest to agriculture and other uses (USFWS 1998). Resort or recreational developments, farming, road construction, pesticide use, and wildfires are expected to persist into the future, and have the potential to result in habitat loss or alteration, either directly or through the introduction or spread of invasive plant and insect species. Other direct impacts to bats associated with these activities may occur through collisions with structures, such as barbed wire fences, wind turbines, and communications towers, or disturbance at roost sites. These activities may also indirectly affect bats through the displacement or reduction in the number of prey resources. The cumulative impacts assessment considers several parameters including 1) take permitted on Maui, 2) take permitted on other islands, 3) potential future projects, and conservation measures such as protected lands, mitigation, and research as described below.

In addition to the Hawaiian hoary bat take authorized under the approved HCP, the only other authorized take of the Hawaiian hoary bat on Maui is from two other industrial-scale wind farms operating with approved HCPs. The Kaheawa Wind Phase I Project (20 GE 1.5-MW wind turbines) and Kaheawa Wind Phase II Project (14 GE 1.5-MW wind turbines) are located on west Maui and have authorized take levels of 50 bats and 11 bats over 20-year permit terms, respectively (KWP LLC 2006, SWCA 2011). Due to higher than anticipated incidental take levels of bats, Kaheawa Wind Phase II is in the process of amending its HCP (ESRC 2015), and has requested additional take of 27 bats. The take for all existing Maui projects is estimated at 11.4 bats per year. Based on the population estimate provided above for Maui, cumulative impacts are 1 percent (or less) of the population per year. The cumulative impact of all current Maui wind projects is not expected to have a significant impact on the population of Hawaiian hoary bats on the island, even without consideration of the associated mitigation activities of these projects.

The activities that directly impact bats on Maui (identified above), also occur on O'ahu and Hawai'i Island. The direct impacts from other authorized or proposed actions that could take bats include the following:

- Authorized take approved for two existing wind projects on O'ahu (Kawailoa is seeking an amendment to increase the amount of authorized Hawaiian hoary bat take);
- Requested take for one proposed wind project on O'ahu; and
- Requested take for two existing wind projects and one restoration project on Hawai'i Island.

Take authorization for these wind farms is contingent upon approved mitigation, which is expected to fully offset these projects' take or mitigate to the maximum extent practicable. However, movement of bats between islands is anticipated to be rare; therefore, the Project would only be expected to contribute to any cumulative impacts to the population on Maui alone.

Table 5-3. Current and Requested Take Authorizations for the Hawaiian Hoary Bat through Habitat Conservation Plans Associated with Wind Farms and Other Development in Hawai'i

Applicant	Permit Duration	Megawatts	Location	Current Take Authorization[1]	Take Request for Future HCP or HCP Amendment[1,2]
Kahuku Wind Power[3]	2010 – 2030	30	Kahuku, O'ahu	32 bats	NA
Kaheawa Wind Power I	2006 – 2026	30	Maalaea, Maui	50 bats	NA
Kaheawa Wind Power II	2012 – 2032	21	Maalaea, Maui	11 bats	38 bats
Kawailoa Wind Power	2012 – 2032	69	Kawailoa, O'ahu	60 bats	222 bats
U.S. Army Kahuku Training Area Single Wind Turbine[3]	2010 – 2030	NA	Kahuku, O'ahu	2 adults, 2 juveniles bats	NA
Auwahi Wind	2012 – 2037	24	Ulupalakua Ranch, Maui	21 bats	140 bats
Na Pua Makani Wind Farm	2019-2040	25	Kahuku, O'ahu	51 bats	NA
Pakini Nui Wind Farm	Draft requested (20 years)	21	Hawai'i Island	NA	26 bats
Lalamilo Wind Farm	Draft requested (20 years)	3.3	Hawai'i Island	NA	6 bats
Pelekane Bay Watershed Restoration Project[3]	2010 – 2030	NA	Hawai'i Island	16 bats	NA

1. Total take authorization includes adult and juvenile bats; number of adult equivalents provided by D. Sether, USFWS, 2018.

2. Total includes previous authorized take.

3. Take authorized under ESA Section 7 Biological Opinion.

These take rates are likely to decline as the risk factors associated with Hawaiian hoary bat fatalities are researched, and minimization measures are improved for wind farms. Additionally, several companies are working to develop effective bat deterrents and conducting research into ultrasonic and ultraviolet deterrents to reduce the risk of bat fatalities at wind farms. The future installation of bat deterrents at wind farms in Hawai'i is anticipated, and would further reduce the risk of cumulative impacts to the bat if implemented for operational and future projects.

The likelihood of new development must also be considered in the impacts to species. The Hawaiian Electric Companies (HECO) issued a renewable energy request for proposals seeking to develop an additional 60 MW of renewable energy on Maui (HECO 2018) in Phase 1 and issued a draft proposal for Phase 2. No new wind energy projects were identified for Maui in 2018 and it is not known what type of projects will be selected for Phase 2. It is not known if HECO will initiate new requests in the next 5 years, but the start of operations of a new project in the next 5 years as part of a new RFP is unlikely, given that no projects were identified in 2018. The Hawai'i Clean Energy Initiative (HRS 196-10.5) and Renewable Portfolio Standards (HRS 269-92) specifies that the State of Hawai'i will establish a renewable portfolio standard of 100 percent of net electricity sales from renewable sources by 2045. The new wind projects would be anticipated to be proposed in the future, but the timing, approval, construction, and operation of such projects is uncertain, and therefore it is not possible to incorporate such information into the analysis of cumulative impacts.

Additionally, Hawaiian hoary bats have been documented on Kaua'i, Molokai, and Lana'i. These three islands have no wind energy projects, and the populations would not be expected to be impacted by any of the existing wind projects or likely any future projects. As previously stated, the populations of individual islands are considered distinct. The existence of the species on these islands is a further assurance of the persistence of the Hawaiian hoary bat.

Another documented mortality source for Hawaiian hoary bats involves the bats becoming snagged on barbed wire; this is a concern statewide, with rates on Maui expected to be similar to the statewide range of 0.0-0.8 Hawaiian hoary bats per 62 miles of barbed wire (Zimpfer and Bonaccorso 2010). Observed fatalities are uncommon, because most fences are not checked regularly, and bats caught on these fences may quickly be taken by predators or scavengers. Based on the low estimates of mortality related to bat impalement on barbed-wire fences, the impact of the HCP Amendment in combination with this impact is not expected to result in significant cumulative impacts to the species on Maui, or statewide. Other anthropogenic sources of take potentially include: timber harvesting, drowning, pesticides, predation or competition from introduced species, and climate change. The scale of the impacts from the identified activities is not monitored, but it is thought to be minimal (USFWS personal communication April 2019).

Another consideration for impact assessment is the abundance of forested and/or protected lands on Maui and statewide that would serve as habitat for the Hawaiian hoary bat. Conservation lands across the state protect habitat likely to be used by Hawaiian hoary bats. Approximately 205,500 acres of conservation lands occur on Maui; over 2 million acres of conservation lands occur statewide. In addition to the 150,000 acres of forest on Maui, an estimated 1.5 million acres of forest habitat occur across the state. These lands would be expected to provide available habitat that would enable the Hawaiian hoary bat to continue to survive and reproduce, despite anthropogenic losses.

Approved and pending authorized levels of bat take would be expected to be fully mitigated, with the exception of the U.S. Army Kahuku Training Area and Pelekane Bay Watershed Restoration Project, for which mitigation is a recommendation under the USFWS's ESA Section 7 Biological Opinion (USFWS 2003), but not required. The approved and pending HCPs include a combination of habitat restoration and research (see Section 6.0 for Project-specific Hawaiian hoary bat mitigation under the HCP Amendment). Habitat restoration is intended to create or improve the quality of bat foraging and roosting habitat; the Hawaiian hoary bat recovery plan (USFWS 1998) identifies the loss and degradation of habitat as a major factor impacting the species. Restoration actions incorporated into the approved and pending HCPs include installation of ungulate fencing, the removal of non-native ungulates and invasive plant species, and/or planting of native trees and shrubs. Over time, these actions are anticipated to create high quality, sustainable, native foraging and roosting habitat, benefiting bats beyond the ITP/ITL terms, and thereby resulting in a net benefit to the species.

The research component of the mitigation is critical to filling data gaps about the species, and was identified as a priority recovery action in the Hawaiian hoary bat recovery plan (USFWS 1998). Research projects approved by USFWS and DOFAW are designed to gain an understanding of basic life history parameters and develop effective mitigation measures for the species (DOFAW 2015), which will ultimately guide future management and recovery efforts.

The impacts of the Project and the cumulative impacts of wind energy on Maui are unlikely to have a significant negative impact on the Hawaiian hoary bat population. The process of estimating take for the HCP Amendment using EoA and PCMM data provides a high degree of certainty that actual take will be less than predicted take. Current and pending actions of HCPs are expected to fully mitigate for their take, and provide a net benefit as required by Hawaii law, thus the cumulative impact to the Hawaiian hoary bat associated with the increased take from the HCP Amendment is expected to be none to minimal. Pursuant to USFWS and DLNR ITP/ITL issuance criteria, the provisions described in the HCP amendment, including the avoidance and minimization measures, mitigation, and adaptive management program, identify how any bat take will not jeopardize the survival and recovery of the species. The mitigation described in Section 6.2.4 and 6.2.5 increases the chances of survival and the likelihood of recovery for the listed species by providing a net benefit to the species.

5.1.4 Tiers of Take

To address the uncertainty associated with the effectiveness of the proposed LWSC program in reducing direct bat take (Section 4.2.7) and the conservative assumptions used in estimating future take as described above, Auwahi Wind divided the new requested take into three additional tiers (Tiers 4 – 6; Table 5-4). The additional tiers are based on varying percentages of reduction in bat take as a result of effectiveness of LWSC, ranging from 30 to 70 percent.

The three proposed tiers of take are representative of the uncertainty associated with the degree of effectiveness minimization and adaptive management measures will have in terms of reducing the take of Hawaiian hoary bats. The best available public information (Appendix G) suggests LWSC minimization measures may reduce bat take up to 76 percent relative to the current estimated take. Auwahi Wind assumes a more conservative approach, because the effectiveness documented in other studies is subject to site-specific conditions and may vary with different sites. Auwahi Wind based the new tiers on three take rates to represent the uncertainty of the effectiveness of LWSC: 70 percent reduction from current take rates (Tier 4), 50 percent reduction from current take rates (Tier 5), and 30 percent reduction from current take rates (Tier 6). For example, reducing the take rate by only 30 percent would equate to an average take of 7.00 bats per year (140 bats/20 years) over the life of the Project and a higher overall take estimate. However, if the take rate is reduced by 70 percent relative to past monitored years, the take rate over the life of the Project would be expected to be an average of 4.05 or fewer bats per year (81 bats/20 years). These projections of take form the biological basis for Tiers 4 – 6.

For the potential future scenarios, the EoA analysis utilized data through December 31, 2017, and an average detection probability (ghat) value from canine searching, as well as 2017 study parameter data, to estimate take in years 2018 – 2032. The values of estimated take associated with each percentage of reduction in take rate, were allotted to each tier based on USFWS recommendations for tiered take at wind facilities (USFWS 2016b). Each tier represents the cumulative total take (direct and indirect) requested (i.e., take is not additive among tiers).

This tier framework helps address variation and uncertainty due to 1) the inter-annual variability in observed take, 2) the effect of small sample sizes on take predictions, 3) the potential for a stochastic event in 2016 to have disproportionately influenced predictions of future take, and 4) the high degree of conservatism used in the estimation process. The tier framework also allows for new information, to be incorporated into future tier mitigation projects (see Section 3.8.1 and Section 7.4.1.2). Triggering of mitigation for the associated tiers of take is discussed in Section 6.2.5.

Table 5-4. Tiers of Take for the Hawaiian Hoary Bat

Tier[1]	Cumulative Estimated Take	Take in Tier	Basis for Take within Designated Tier[2]
1	5	5	Estimate developed in approved HCP.
2	11	6	Estimate developed in approved HCP.
3	21	10	Estimate developed in approved HCP.
4 (New)	81	60	Assumed reduction in take rate of 70% in years 2018-2032 (relative to the current take rate).
5 (New)	115	34	Assumed reduction in take rate of 50% in years 2018-2032 (relative to the current take rate).
6 (New)	140	25	Assumed reduction in take rate of 30% in years 2018-2032 (relative to the current take rate). Represents baseline condition for estimated take request.

1. Each tier represents the total take requested (i.e., take is not additive across tiers).
2. The scenarios described are representative of the conditions that could result in take being limited to each specific tier. Many factors may affect estimates, and none of these can be known in advance. All scenarios utilize EoA analysis utilizing data through December 31, 2017, and overall detection probability derived from canine searching.

5.2 Hawaiian Petrel

This section requires no edits for the HCP Amendment.

5.3 Nene

This section requires no edits for the HCP Amendment.

5.4 Blackburn's Sphinx Moth

This section requires no edits for the HCP Amendment.

6.0 COMPENSATORY MITIGATION FOR POTENTIAL IMPACTS

This section requires no edits for the HCP Amendment.

6.1 MITIGATION LOCATIONS

This section requires no edits for the HCP Amendment.

6.2 HAWAIIAN HOARY BAT

Mitigation for additional tiers of take under the HCP Amendment was informed by the recovery priorities described in the Hawaiian Hoary Bat Recovery Plan (USFWS 1998), the best available information on the Hawaiian hoary bat and other bat species, and supplemented by the April 2015 ESRC workshop, the resulting ESRC Bat Guidance (DOFAW 2015) for projects that have the potential to positively impact the species. The results of this workshop and subsequent ESRC Bat Guidance included:

- Recognition of the need for more research to understand the Hawaiian hoary bat life history and limiting factors;
- Identification of research priorities that would help develop effective mitigation strategies; and,
- Recognition of the need to closely monitor a variety of habitat restoration projects to measure their benefits to the Hawaiian hoary bat.

As described in Section 3.8.1.1, several research projects were approved as mitigation for wind HCPs based on research priorities and costs identified in the ESRC Bat Guidance (DOFAW 2015). The ESRC Bat Guidance recommends mitigation for the Hawaiian hoary bat be valued at $50,000 per bat (DOFAW 2015); however, USFWS provided revised verbal guidance in May 2018 to clarify that the $50,000 per bat rate only applies to research approved as mitigation for bats. Furthermore, USFWS and DOFAW current guidance (USFWS and DOFAW meetings May 1, 2018) is that land-based mitigation projects are preferred, and research is considered to be a lower priority until the results of the current research projects are known. Land-based mitigation efforts should have clear biological goals and objectives, and thus, measures of success that tie directly or by proxy, to increases in reproductive success, or increases in rates of use by the Hawaiian hoary bat. No additional research-based mitigation is proposed for Tiers 4-6 under this HCP amendment.

6.2.1 Tier 1 Mitigation

Tier 1 mitigation for the Hawaiian hoary bat is on-going and has met Interim Success Criteria; it consists of Hawaiian hoary bat habitat restoration measures and on-site acoustic monitoring. The Pu'u Makua parcel of the Waihou Mitigation Area was placed into a conservation easement held by the Hawaiian Islands Land Trust (HILT) on December 18, 2012. Restoration measures for approximately 130 acres of pastureland in the parcel were initiated following issuance of the

ITP/ITL. In September 2013, an ungulate-proof fence surrounding the parcel was completed, and all ungulates were removed from the parcel by January 2014. Following initial baseline vegetation monitoring of the parcel in March 2014, biannual sweeps to remove primary invasive plant species were initiated. A second baseline survey was conducted in February 2015, and native tree out-planting began in spring 2015. Thirty-nine acres of native trees were out-planted in 2015 (Figure 6-1). Native reforestation, vegetation monitoring, and invasive species removal efforts are ongoing. In addition, acoustic monitoring of bats was conducted at the Project from July 2013 through December 2015 using two ground-based acoustic monitoring units as required.

Auwahi Wind has exceeded the Interim Success Criteria established for Year 3 (FY 2018). The target for non-native plant cover (excluding kikuyu grass, *Pennisetum clandestinum*) for Year 3 was set at less than 75 percent; measured non-native plant cover in FY 2018 was 4.5 percent. The target for native species outplantings survival for Year 3 was set at 75 percent; actual survival was 87 percent survival across plots for Year 2, and ongoing outplantings to replace lost plants (May 2017–June 2018) ensures that the interim and long-term mitigation targets are reached.

Figure 6-1. Aerial Image of Most Outplantings (image taken using a DJI inspire drone and shot in June 2018)

6.2.2 Tier 2 and Tier 3 Mitigation

Tier 2 and Tier 3 mitigation is also on-going and being successfully implemented. The mitigation includes funding of Hawaiian hoary bat research that contributes to knowledge of the species on Maui. Beginning in 2013, Tetra Tech, Inc. and Dr. Frank Bonaccorso (USGS) worked together to develop a phased research plan to use acoustic monitoring and radio telemetry methods to:

- Evaluate home range size and habitat composition;

- Evaluate seasonal patterns of bat activity at the Waihou Mitigation Area; and
- Examine prey abundance and diet composition by bats in the Waihou Mitigation Area.

The Tier 2 research plan was approved by USFWS and DOFAW in February 2014. Acoustic monitoring efforts were initiated at the Waihou Mitigation Area in March 2015. Subsequently, the Tier 3 research plan expanded the sampling and scope of the approved Tier 2 research plan. The final Tier 2 – 3 research plan was approved by USFWS and DOFAW in May 2016. This research plan includes acoustic monitoring (2015 – 2018), seasonal radio telemetry (2016 – 2017) with two additional phases of radio-telemetry to be completed and timed based on results from on-going acoustic monitoring efforts, an insect prey base study (2016), and a food habit assessment (2016 – 2017). The radio-telemetry component of this project was replaced in 2017 with additional monitoring (outlined below) through adaptive management in consultation with USFWS and DOFAW due to broadcast tower interference with radio-telemetry signals. Adaptive management measures to the research component include:

1) Increase in the staff effort devoted to nights of mist-netting at Pu'u Makua and outlying areas within the Ranch, to capture bats for genetic sampling and fecal collection;
2) Add a second season of insect prey base sampling at the Waihou Mitigation Area and mist net sites, where only a single season was previously planned/budgeted;
3) Increase the number of insect prey species (up to 150 insect samples) that will be bar-coded for a larger library to match with insect fecal pellets in a dietary study;[7] and
4) Add other potential items to the scope of work if field time and funds allow:
    a. Adding one acoustic meter near the location called Duck Ponds; and
    b. Adding insect prey base sampling at the Project.

These efforts are on-going with results to be provided in HCP annual reports.

While no capture rates are recorded prior to mitigation and as such no baseline is available for comparison, the initial results of this work indicate a higher use rate than predicted by mitigation targets for Tier 1. The USGS tagged 11 Hawaiian hoary bats in the Waihou Area while conducting monitoring for Auwahi Wind under Tier 2-3 mitigation.

6.2.3 Tiers 4 – 6

The mitigation described in this HCP Amendment for Tiers 4 – 6 will offset the requested bat take. A detailed outline for Tier 4 Mitigation is provided in Section 6.2.4, while the mitigation program for Tiers 5 and 6 is described in Section 6.2.5. Adaptive management for Tiers 5 and 6 mitigation will

[7] This effort is distinct from the USGS proposal currently accepted by the ESRC, although the analysis will be in parallel.

provide an opportunity for Auwahi Wind to incorporate the best available science and results from ongoing research described in Section 3.8.1.1 and the results of Tier 2-3 mitigation.

In addition to the mitigation provided for Tiers 4 - 6, Auwahi Wind will conduct a single-year occupancy study of the Hawaiian hoary bat on Leeward Haleakalā. The study area spans from Ahihi-Kinau Natural Area Reserve to Kaupō gap, and from the summit of Haleakalā to the coast. The study methods are consistent with, and comparable to, the multi-year occupancy study occurring on O'ahu developed in collaboration with the ESRC Bat Task Force. Based on prior studies (Todd et al. 2016, Starcevich et al. 2019), a sample of 20 detectors will be installed. The study begins in July 2019 and continues for 1 year. Single-year occupancy models (MacKenzie et al. 2019) will be used to estimate occupancy rates and detection probabilities, and covariate relationships where possible (MacKenzie et al. 2019). Although Auwahi Wind's mitigation is consistent with the ESRC Bat Guidance recommendations as described below, this occupancy study provides a significant additional research benefit.

6.2.4 Tier 4 Mitigation

The objective of the Tier 4 Mitigation is to protect, manage, and enhance habitat that is suitable for bat foraging and roosting through the addition of features necessary for those stages of the Hawaiian hoary bat life cycle. Auwahi Wind has leveraged results of the research and restoration efforts conducted in Tiers 1 – 3, data from other applicable studies, and USFWS and DOFAW mitigation guidance, to identify appropriate Tier 4 mitigation that will offset the incidental take of at least 60 bats.

Auwahi Wind's Hawaiian hoary bat Tier 4 Mitigation will be located on 1,752 acres of Leeward Haleakalā, on Ranch land (Mitigation Area; Figure 6-2). The proposed Tier 4 Mitigation Area is of relatively high elevation and would be expected to provide primarily foraging and roosting habitat since pupping generally occurs at lower elevations (C. Pinzari, personal communication August 1, 2018). The mitigation actions included in the Tier 4 Mitigation will protect existing bat habitat as well as enhance bat habitat through the addition of resource features to increase bat foraging and roosting in the near and long term and augment the connectivity between nearby State Forest Reserves and other conservation areas that currently provide bat habitat. Auwahi Wind anticipates that the mitigation project will more than fully offset the incidental take of 60 Hawaiian hoary bats and provide a net benefit based on the following:

- The median CUA for one Hawaiian hoary bat is approximately 20.3 acres (Bonaccorso 2015); the 1,752 acres will provide 29.2 acres for each of the 60 bats covered in Tier 4;
- The size of the CUA of Hawaiian hoary bats varies based on the specific habitat types and features located within a given area;
- Enhancement of bat habitat through the addition of key resource features can reduce the size of an area required for Hawaiian hoary bats to meet foraging needs; and

- Specific habitat enhancements documented in the available literature to be associated with higher bat use rates will be selected and implemented to improve the mosaic of habitat structure.

The following sections provide an overview of the proposed Tier 4 Mitigation by describing 1) the Mitigation Area, 2) the management actions that will be implemented to benefit bats, 3) the estimation of take offset/net benefit, 4) the measures of success to achieve the take offset/net benefit, 5) a monitoring plan, 6) an adaptive management strategy, and 7) a timeline for implementation.

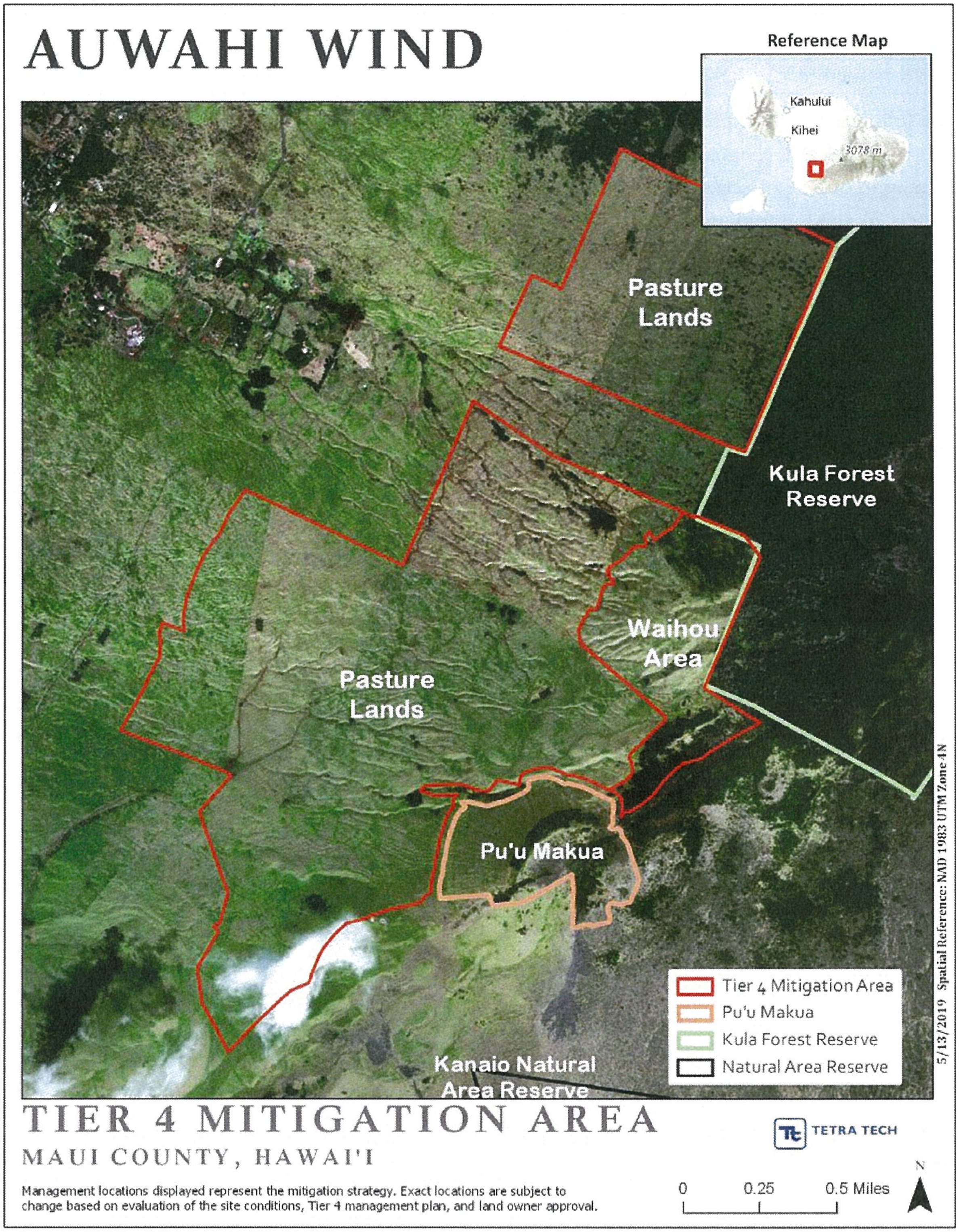


Figure 6-2. Site Location, Aerial Imagery, and Proposed Layout of Mitigation Parcels within the Mitigation Area

6.2.4.1 Mitigation Area

Habitat Description

Auwahi Wind has identified the 1,752 acre Mitigation Area as being a priority parcel for protection and management actions for the Hawaiian hoary bat. The Mitigation Area includes the Waihou Area, the Duck Ponds, Cornwell, and Kaumea Loko parcels identified in the Auwahi Wind HCP as potential mitigation areas. These parcels within the Waihou Area were identified in the approved HCP for future possible mitigation tiers, but were not used for the approved HCP. Bats have been documented within and adjacent to the Mitigation Area. USGS mist netting has resulted in the tagging of 11 individual Hawaiian hoary bats at the Duck Ponds, and USGS has documented bat use of the forest patches within the Waihou Area (Auwahi Wind 2017). Additionally, USGS researchers have recorded bat calls at the nearby Pu'u Makua Mitigation Site (Figure 6-2; Auwahi Wind 2017). Results from USGS research indicate that bats are present year-round at Pu'u Makua. The detectability of Hawaiian hoary bats at Pu'u Makua has varied but fluctuates around the average detectability of 0.38. Detectability represents the nightly frequency of bat presence on a scale of 0 to 1, with 0 describing no bat activity and 1 representing acoustic activity every night within a survey period.

The elevation of the Mitigation Area ranges between 3,300 and 5,500 feet asl, and the land use is commercial cattle ranching. Recent research suggests that resource availability at high elevation sites may be an important limiting factor for Hawaiian hoary bats in the non-breeding season (Gorresen et al. 2018). Under the proposed Tier 4 Mitigation, the property and existing pastures will continue to be used for seasonal grazing, but new management actions will be implemented to protect and enhance bat foraging and roosting habitat, as described in Section 6.2.4.2 below. Protecting and managing these lands with a conservation easement to restrict any future incompatible uses will ensure long-term benefit to the bat and enhance the connectivity to the nearby Kula State Forest Reserve, and the 120-acre Pu'u Makau Restoration Site that provide protected bat roosting habitat (Figure 6-2, Lance DeSilva, DOFAW, personal communication, 10 August 2018; Auwahi Wind 2017). Further details of the legal protections that will be included as part of Tier 4 Mitigation are included under Mitigation Actions (Section 6.2.4.2).

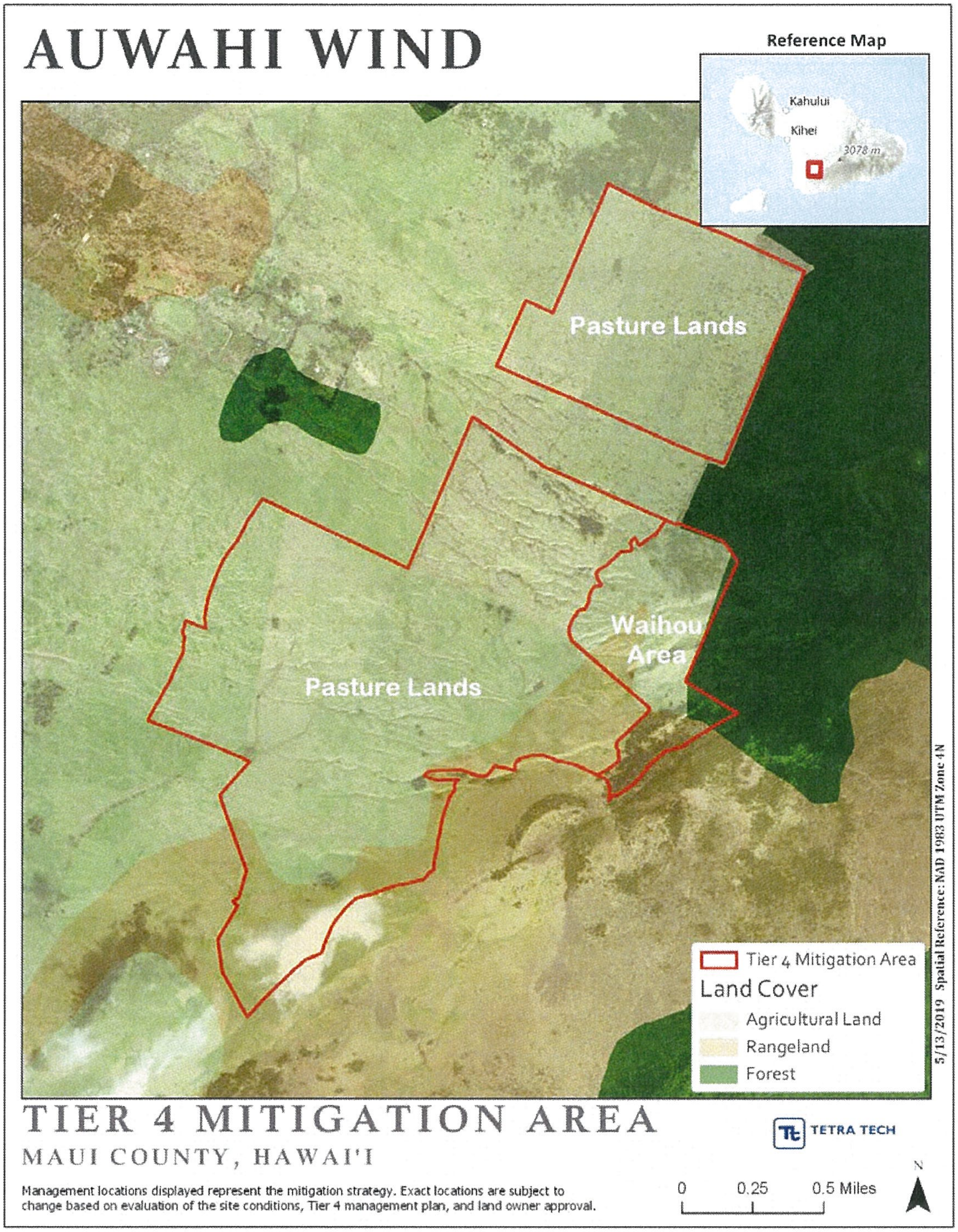
The Mitigation Area consists primarily (more than 95 percent) of sloping open grasslands, interspersed with gulches, and a few forested patches and hedgerows (Figure 6-3). The grasslands consist primarily of Kikuyu grass (*Pennisetum clandestinum*) as well as a mix of other non-native species. The existing open habitats would be expected to provide little benefit to bats except foraging near hedgerows or limited use by bats transiting the area. Although bats have been documented to traverse open areas, their foraging is associated with insect abundance (Bellwood and Fullard 1984), and insect abundance is inversely corelated with distance from woody vegetation (Lewis 1969). The distance to the nearest forest edge has similarly been found to be inversely corelated with bat activity (Downs and Sanderson 2010). The gulches on the property are primarily contained within a 150-acre parcel and have been noted by USGS to provide structure that would likely be utilized by bats. Scattered clusters of trees occur throughout the habitat and several sections of forest which connect to the Kula Forest Reserve. Bats may use these scattered trees (Auwahi Wind 2017).

Auwahi Wind has broken the management program into two units: the Waihou Area and the Pasture Lands (Figure 6-3). The Pasture Lands are 1,556 acres of primarily grasslands as described above. There is a gap in the Pasture Lands parcels which is not owned by the Ranch. The Waihou Area is 196 acres and has approximately 20 percent forest cover, 80 percent grasslands. The general habitat types are shown in the aerial imagery in Figure 6-2 and in Figure 6-4, from data by the Geographic Information Retrieval and Analysis System (GIRAS) provided on the State of Hawaii: Office of Planning website (State of Hawaii 2018).

Water is a scarce resource in Leeward Haleakala, and water resources in the Mitigation Area consist of 5 ponds, seasonally active water troughs, and dry or perennial small streams (Figure 6-5, USGS 2013). The area surrounding the existing ponds is not grazed by cattle and are generally vegetated by non-native grasses (e.g., kikuyu grass; Figure 6-3). The ponds within the Mitigation Area are man-made and consist of an excavated depression up to 10 feet deep and range in size from 40 by 50 feet up to 60 by 120 feet. The ponds are lined with a plastic liner and back-filled, the liner is able to capture rainwater sufficient to recharge a pond within 9 months after that pond has been emptied (Ulupalakua Ranch, personal communication, October 23, 2018).

Hawaiian hoary bats have been documented to use the existing ponds in the Duck Ponds parcel (Auwahi Wind 2017). Created ponds such as those in the Duck Ponds are the only consistent sources of open water in the vicinity (Figure 6-5). Flow lines noted in the National Hydrography Dataset are normally dry and only fill when major flooding occurs. Other water sources such as cattle troughs are only active seasonally, specific to cattle use, approximately 2 to 4 months per year. Fifteen water troughs currently exist within the Mitigation Area (Figure 6-5). Figure 6-3 displays the existing habitat ponds.

Figure 6-3. Pictures of the Mitigation area (top), and one of the existing ponds within the Mitigation Area (bottom).



Source: GIRAS, State of Hawaii Office of Planning 2018

Figure 6-4. Land Cover in the Mitigation Area from Geographic Information Retrieval and Analysis

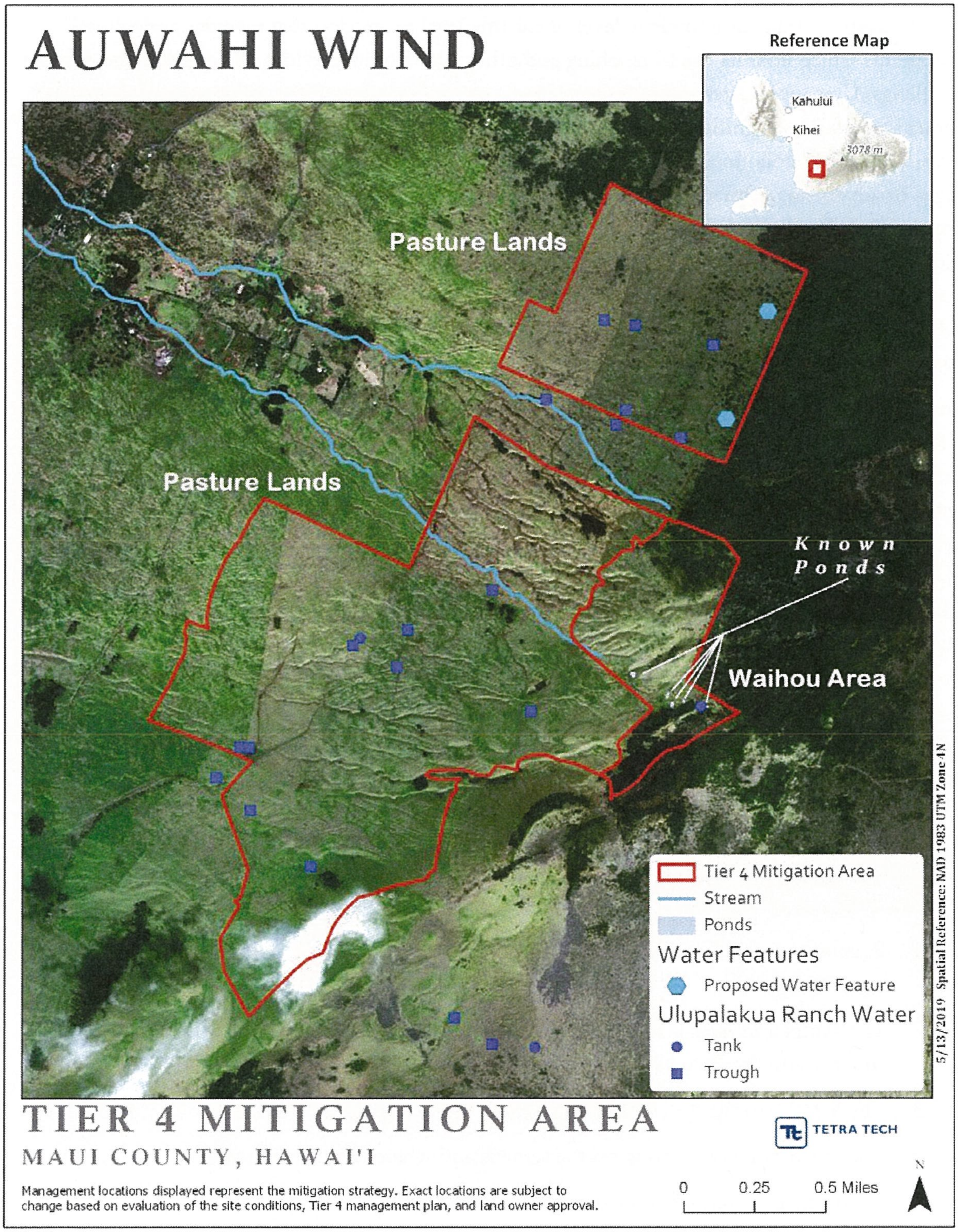


Figure 6-5. Water Resources, Known and Proposed Within the Mitigation Area

Existing Legal Protection

The Mitigation Area has a minimal level of existing legal protection that includes agricultural easements which limit its use to ranching and other agricultural activities and restricts the number of dwellings. Uses inconsistent with the existing easement include: surface mining, subdivision, industrial activities, significant alteration of the surface of the land, activities causing significant erosion or water pollution, alteration of water courses, waste disposal, or the addition of commercial signs or advertising. Other applicable restrictions do not appreciably alter the suitability of the site for the Hawaiian hoary bat and can be found recorded with the State of Hawai'i Bureau of Conveyances. Notably absent from the existing restrictions are limitations on the removal of trees; removal of existing tree cover on the Ranch lands could substantially impact existing bat habitat which occurs in scattered clusters across the Ranch. There are no restrictions on the use of insecticides or stocking ponds with insectivorous fish, which could impact Hawaiian hoary bats.

In the absence of the proposed mitigation's conservation easement, bat habitat quality, and the use of the Mitigation Area by bats, would likely remain low and could diminish in the event that currently permitted changes to land use occur. These lands are not managed for bat habitat purposes, and property features (trees, water features) which provide habitat benefits for bats are not required to be maintained. The Ranch anticipates increasing the number of cattle on their property (Ulupalakua Ranch, personal communication, August 13, 2018), and with land resources scarce in Hawaii, would likely use and manage the existing lands more intensively. Cuddihy (1984) evaluated the difference between grazed and park lands on Hawai'i Island, and showed that grazing is correlated with decreases in structural complexity and increases in cover of non-native grasses despite similarity in soils between treatment and control sites. This study found tree density increased significantly less in a grazed site than adjacent park parcels, suggesting that existing grazing in the Mitigation Area would continue to impair the long-term suitability of the site for Hawaiian hoary bat use, if not managed through the Tier 4 Mitigation.

Mitigation Site Summary

The Mitigation Area is a priority for the following reasons:

1. Resource availability at high elevation sites is suggested to be an important limiting factor for bat populations;
2. The Mitigation Area is located adjacent to existing bat roosting habitat in the Kula Forest Reserve and the Pu'u Makua Mitigation site;
3. The Wind Farm is distant from the Mitigation Area (approximately five miles);
4. The mitigation is occurring on the same island where take is occurring;
5. Bat occurrence has been documented in the Mitigation Area;
6. The Mitigation Area currently consists of low quality habitat, which will be improved through management actions, to increase bat use;

7. The Mitigation Area currently has minimal legal protections, which will be enhanced for the Hawaiian hoary bat, with a permanent conservation easement; and
8. The land owner is a USFWS conservation partner and supportive of the easement and management actions proposed.

6.2.4.2 Mitigation Actions

The mitigation actions described here draw heavily upon literature outlined in Section 3.8.1 above, guidance derived from Bat Conservation International (BCI) for the management of water features (Taylor and Tuttle 2007), and recommendations from the Joint Nature Conservation Committee[8]. The Joint Nature Conservation Committee is a statutory advisory committee for the government of the United Kingdom (Entwistle et al. 2001), which provide guidance for rangeland managers to promote bat use on rangelands. To achieve the mitigation objective of protecting and enhancing bat foraging and roosting habitat in the Mitigation Area, Auwahi Wind will 1) create forested linear landscape features (i.e., hedgerows) that can be used as foraging and night roosting substrate and travel corridors, and 2) provide suitable, consistent water resources for the bat. These added features will increase the amount of available foraging and roosting resources for Hawaiian hoary bats on Maui. Furthermore, the location of the added resources will reduce the energetic costs associated with foraging and drinking by providing suitable foraging grounds and water sources in proximity to day roosting habitat, where none previously existed. In addition to the creation of these two feature types, Auwahi Wind will also implement fire management and legal protection of the Mitigation Area. The combination of these specific mitigation actions will provide immediate, near-term, and long-term benefits to bats.

Reforestation of Hedgerows

Reforestation of fence line hedgerows is recommended to facilitate bats transiting the Mitigation Area and serve as a foraging and roosting substrate (Entwistle et al. 2001, Jantzen 2012).

The reforestation of these hedgerows will provide the Hawaiian hoary bat a patchwork of open foraging areas, edge habitat, and closed canopy which provide shelter from strong winds, night roost habitat, and available prey for foraging. Bats and dung beetles at study sites in Nicaragua were more abundant at hedgerows than in pasture lands with low tree cover (Harvey et al. 2006). Hedgerows serve as both shelter and habitat for insects with insect abundance typically greater in the lee of hedgerows. This pattern of hedgerow use applied for beetle species (*Lathridiidae*) and flies (*Scatopsidae* and *Sphaeroceridae*) while moths were more commonly found within the hedge (Lewis 1969). Hedges are one of the most important non-crop habitats on farmland and support a high biomass of arthropods (Pollard and Holland 2006).

Information on the insect species associated with reforestation of grassland on Maui is available in conjunction with reforestation efforts at the Nakula Natural Area Reserve (NAR) conducted by the

[8] The recommendations of BCI and the Joint Nature Conservation Committee are not species-specific.

Maui Forest Bird Recovery Project since 2011. Reforestation efforts in the Nakula NAR have resulted in 98 acres of reforested grasslands. The insect abundance in the Nakula NAR was evaluated in 2011 (Peck et al. 2015) in the existing koa stands to look for food species of the kiwikiu (Maui parrotbill; *Pseudonestor xanthophrys*) and Maui ʻalauahio (Maui creeper; *Paroreomyza montana*). The diet of these two forest birds includes significant portions of moth larvae and beetles, which suggests an overlap with bats in the insect species consumed (bats are not expected to feed on larvae, but rather, flying adult moths and beetles, Todd 2012). Species composition was dominated by moths with a significant portion of beetles. Total insect biomass was not significantly different than Waikamoi (which is mature native forest), suggesting the Nakula NAR prey base can support Hawaiian birds. Analysis of insects at Waihou also demonstrates that koa and a'ali'i support lepidopteran and coleopteran species (Auwahi Wind 2017). The availability of these insects would also be expected to benefit Hawaiian hoary bats by providing available insect biomass for foraging. All of these studies indicate that hedgerows of koa and a'ali'i in the Mitigation Area would be anticipated to increase the insect biomass available for foraging bats.

The continued grazing of pastures between hedgerows is anticipated to facilitate bat foraging in the Mitigation Area and expected to provide insect biomass for bat foraging. Studies recommended by C. Pinzari (Corinna Pinzari, HCSU, personal communication, 7 Aug 2018) showed that bats in Italy and the United Kingdom use cattle grazing areas as a foraging resource with bat activity increasing with herd size (Ancillotto et al. 2017, Downs and Sanderson 2010). Additionally, the distance to the nearest forest edge and nearest tree were significant covariates of bat activity and distance was negatively correlated with activity. The significance of distance to forest edge shows that the addition of hedgerows fundamentally changes a bat's ability to access foraging resources in pasture lands. The species studied above are hawking insectivorous bats, a trait common with the Hawaiian hoary bat. The habitat needs for these species is associated with grazing and this combination of habitat features is expected to enhance bat foraging, because bats utilize insects associated with cattle and cattle dung as prey (Ancillotto et al. 2017, Downs and Sanderson 2010). Moth abundance is associated with an intermediate level of grazing (Pöyry et al. 2004). Similarly, grazing can reduce the vegetation cover to promote conditions where bats could more easily capture prey (Rainho et al. 2010). In Hawai'i, a decrease in Hawaiian hoary bat activity was linked to the elimination of ungulates in the Kahikinui Forest Reserve on Maui (Todd et al. 2016). The consumption of dung beetles has been noted in the diet of Hawaiian hoary bats (Whitaker and Tomich 1983). These studies suggest that grazing is a compatible land use with the actions taken to benefit the Hawaiian hoary bat.

Therefore, Auwahi Wind will reforest the hedgerows within the 1,556 acres of Pasture Lands Mitigation Area (excludes the Waihou Area). The Pasture Lands will be reforested to a minimum density of approximately 20 percent or 311 acres of forest cover (Figure 6-6), which corresponds to the first statistically significant peak in mainland hoary bat utilization (Jantzen 2012). For Hawaiian hoary bats, canopy cover has been documented to be negatively related to bat detection (Gorresen et al. 2015) supporting the findings from mainland hoary bats, which suggest open areas for foraging in proximity to trees is important.

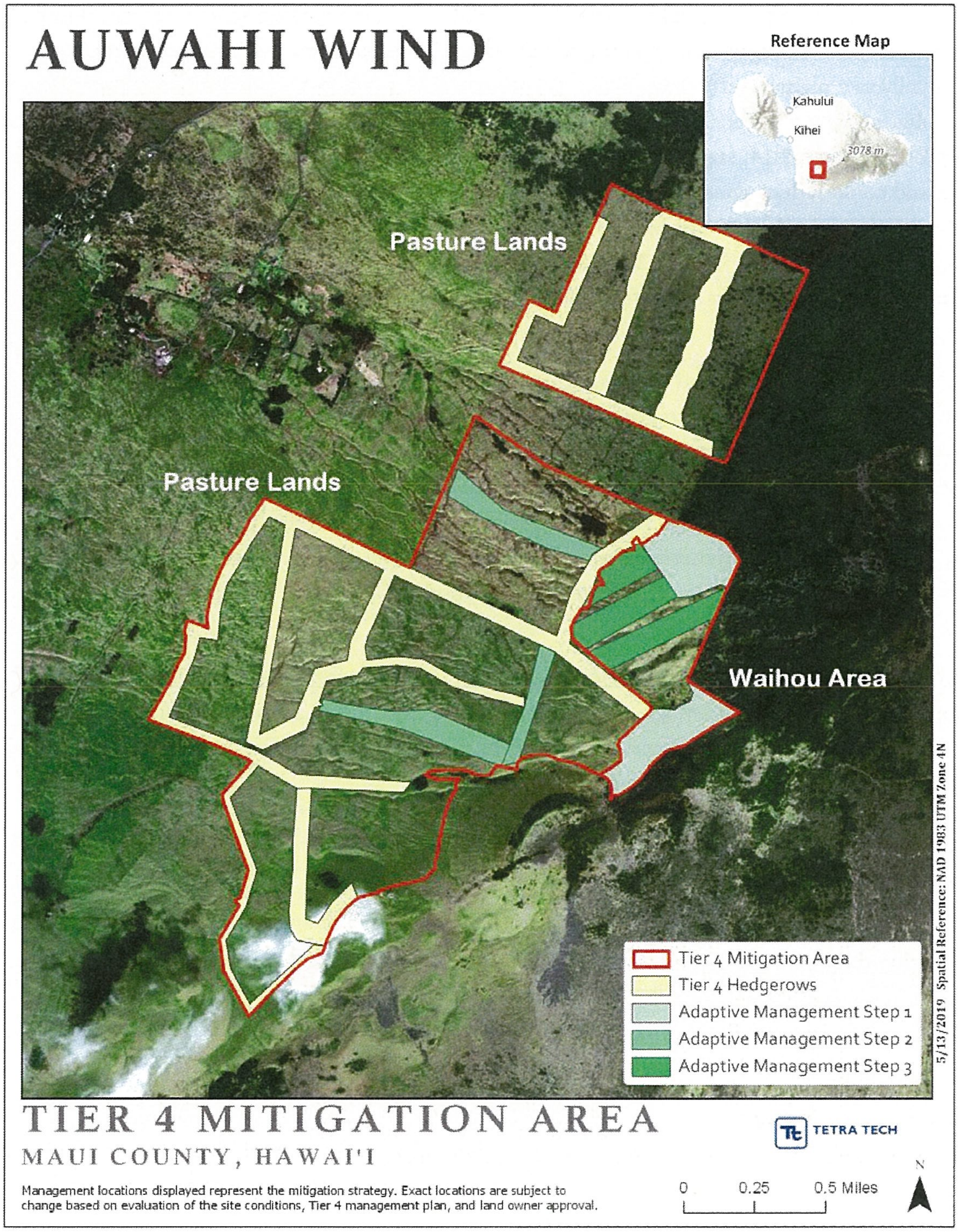


Figure 6-6. Management Plan for the Reforestation of Hedgerows

Within the hedgerows, trees will be planted to a density of approximately 200 trees per acre or 15-foot (4.6-m) spacing. The hedgerows will be at least 80 feet wide (6 trees across) to provide linear landscape features, wind breaks, and foraging substrates for the Hawaiian hoary bat. The width of hedgerows was developed in consultation with USGS. U.S. Geological Survey researchers indicated that the hedgerows, regardless of width, would primarily be used as a foraging substrate and potentially as a night roost[9], but day roosting would likely occur in the nearby Kula Forest Reserve. Consultation with the Ranch, evaluation of the predominant weather patterns in the area, and data from Böhm et al. (2014) suggest that hedgerows of 80 feet should provide sufficient shelter from the wind and could reduce wind speeds by over 50 percent relative to open pastures. Numerous studies of bat species using hedgerows have documented hedgerow width ranging from 15 feet or single trees in width to 80 feet (Jantzen 2012, Lacoeuilhe et al. 2018, Kelm et al. 2014, Böhm et al. 2014). Gaps in hedgerows, such as for gates, will be minimized, ideally less than 30 feet and not exceed 650 feet each.

The hedgerows will be planted with fast growing native trees and understory species. The selection of tree species will be subject to availability and the suitability of tree species for Hawaiian hoary bats. Koa (*Acacia koa*) is preferred as it is expected to provide available insect biomass, available night roost locations, and is fast growing. A'ali'i (*Dodonaea viscosa*) is preferred for the understory. Koa and a'ali'i are selected as preferred hedgerow species because they have been demonstrated to be associated with both an increased abundance and diversity of insect species (Peck et al. 2015, Auwahi Wind 2018), including (Coleopterans) and moths (Lepidopteran), that are prey items for Hawaiian hoary bats (Todd 2012).

The hedgerows are intended to be fenced to prevent ungulates from damaging the out-planted trees. Auwahi Wind will utilize existing fences where available and install additional fencing[10] to surround the reforestation areas where necessary to prevent the ingress of ungulates and promote the long-term habitat suitability of the reforested areas.

Water Feature Management

Water Trough Egress Structures

Following recommendations from BCI for bats in general (Taylor and Tuttle 2007), Auwahi Wind will retrofit the existing troughs with wildlife egress structures. The egress structures ensure that any bats or other wildlife which fall into the troughs are able to escape and avoid drowning. The retrofit of troughs will decrease the risk of drowning for available water troughs within the Mitigation Area.

Pond Installation

Auwahi Wind will install two new ponds to increase the availability of water sources in the Mitigation Area. The ponds will have an approximate minimum size of 20 feet (6.1 m) in diameter

[9] Night roosting is differentiated from day roosting. Night roosting bats use available substrates to rest and digest after eating.

[10] All fencing used will be bat-safe, and free of barbed wire.

and a volume of 50,000 gallons. The minimum size of the pond was selected based on BCI recommendations for ponds which can be utilized by most bat species, and a greater surface area will be utilized where possible. The exact size and shape of the ponds will depend on the site conditions. Larger ponds are currently utilized by hoary bats at the nearby Duck Ponds site, and the installation of such ponds would be expected to significantly increase bat foraging and drinking resources. The pond design would incorporate varying water depth to facilitate insect species associated with shallows that serve as prey for bats. The ponds will be fenced to exclude cattle, and such fencing will be sufficiently far from the pond so as not to pose a collision hazard for bats. The existing ponds are naturally replenished by rainfall, which can be up to 60 inches per year (Ulupalakua Ranch, personal communication, 23 October 2018). The newly installed ponds would be expected to be naturally replenished by rainfall as well. Should rainfall be insufficient, management of the water supply will be modified through adaptive management (Section 6.2.4.7).

Fire Prevention

Fires are identified as one of the threats to the Hawaiian hoary bat (Section 3.8.1.2), and are a constant threat in Hawai'i, having increased fourfold in recent decades (Trauernicht and Pickett 2016). In Leeward Haleakalā, fires are recorded between Ulupalakua and Kaupo gap regularly. Fires in Kula State Forest reserve are rare but devastating, with major fires recorded in 1954, 1984, and 2007. In 2007, one of the most devastating wildfires burned 2,300 acres of the Kula Forest Reserve. The 2017 Kula Forest Reserve management plan cites this as the most devastating fire to happen in Hawai'i in decades. Fires threaten to destroy essential bat roosting habitat in the Kula State Forest reserve, Kanaio Natural Area Reserve, Waihou Area, and other available roosts. Additionally, fires can destroy the vegetation and insects which support Hawaiian hoary bat foraging. Therefore, fire prevention actions taken by Auwahi Wind will provide additional protection of bat foraging and roosting habitat.

In wildland firefighting, helicopters carrying 100-gallon tanks are used to supply water to prevent the spread of the fire. DLNR Division of Forestry has been seeking additional water sources in the Leeward Haleakala area but has been unable to secure funding and landowner support (Lance DeSilva, personal communication, August 10, 2018). The two 50,000-gallon ponds described above, sited adjacent to the Kula Forest reserve, will be designed to facilitate the aerial firefighting efforts essential for wildland fire prevention and serve as dip tanks. The addition of these larger ponds will allow for helicopters to fight fires to protect not only the Mitigation Area, but also adjacent lands including the Kula State Forest Reserve, Waihou Area, and the Kanaio Natural Area Reserve. The pond would be replenished over time from available water sources (i.e., rainfall).

Legal Protection

A permanent conservation easement will be conveyed over the Mitigation Area to the HILT. Certain covenants and restrictions will be placed on the protected Mitigation Area and shall be funded by Auwahi Wind, LLC. This easement will not supersede the existing agricultural easement but will impose additional servitudes which are necessary and appropriate for carrying out the Mitigation

Area bat-focused conservation measures, identified in the proposed Tier 4 Mitigation plan. As the easement grantee, HILT will ensure compliance with the covenants, terms, conditions and restrictions contained in the easement. Where the conservation easement differs from the agricultural easement the more restrictive easement shall apply.

The additional protections or restrictions which will be imposed on the Mitigation Area through the conservation easement include:

- Prohibiting removal of trees over 15 feet tall during the bat pupping season (April 1 through September 15);
- Protection of the hedgerows from removal;
- Maintaining ponds according to this mitigation plan;
- Prohibitions on the use of insecticides;
- Prohibiting artificial stocking of ponds with fish known to reduce insect populations; and
- Prohibiting the use of barbed wire when installing fencing or other such structures.

The parcel management provided by HILT includes:

- Holding rights surrendered by the landowner;
- Protection and preservation of the property set forth in the easement;
- Enforcement of the restrictions put forth in the easement; and
- Access to the lands in the easement for annual or more frequent monitoring for compliance with easement conditions.

The legal protection of the parcel ensures that future management actions are consistent with conditions that are favorable to bats, that are provided by the management actions above. These restrictions would prohibit removal of the hedgerows for all future land owners ensuring baseline reforestation efforts outlined above are maintained for many generations of bats. Koa is a long-lived species and thus would benefit many generations of bats. The maximum age of koa recorded by the U.S. Department of Agriculture (Baker 2009) range between 50 and 80 years. Koa can live much longer than 80 years, but the length of the data sets limit the maximum ages recorded. Therefore, the legal protection outlined here would protect the reforested hedgerows for an additional 50 to 80 years or more without additional restoration efforts. The addition of ponds is documented to facilitate bat use as described above. The restrictions on insecticides provide assurances that the insect prey is not removed for ranching (or other) purposes. The prohibition on the stocking of ponds with insectivorous fish prevents the features installed from being degraded or reduced in their suitability to support the additional bats protected in this plan. Finally, the prohibition on the use of barbed wire in the easement confirms that the threat of snagging bats (a documented threat) is an inconsistent land use.

6.2.4.3 Take Offset/Net Benefit

The Auwahi Wind Tier 4 mitigation package provides a combination of permanent habitat preservation, habitat restoration and enhancement, and research measures for the Hawaiian hoary bat; each mitigation measure is identified as a priority for recovery of the species by the ESRC Bat Guidance (DOFAW 2015) and the USFWS Recovery Plan (USFWS 1998). The mitigation package provides permanent legal protection of 1,752 acres, which are located adjacent to the Kula Forest Reserve and the Pu'u Makua restoration area, larger areas that support bats. In addition, the prescriptive management actions will enhance bat foraging and roosting habitat. As currently utilized, the 1,752 acres are of only marginal quality as bat habitat, and without Auwahi's bat-focused management plan, its suitability for bats will likely decrease over time. The combination of location, permanent legal protection, habitat restoration and enhancement, and habitat management, will fully offset the take of 60 Hawaiian hoary bats and provide a net benefit to the species. This multi-faceted mitigation approach is consistent with the ESRC Bat Guidance which states that habitat restoration that enhances or increases forested and foraging areas for bats is an optimum mitigation approach (DOFAW 2015).

USFWS and DOFAW consider protecting or enhancing habitat within the CUA of a bat as a benefit to the species. An acreage-based offset of 20.3 acres per bat is based on the best available science and is supported by USFWS (USFWS 2018) and DOFAW (DLNR 2018).[11] The Auwahi Tier 4 mitigation area exceeds this offset standard by permanently preserving approximately 29 acres per bat (1752 acres/60 bats = 29.2 acres/bat). Thus, utilizing the agencies' 20.3 acres per bat standard, the Auwahi Tier 4 mitigation actually offsets the take of 86.3 bats (1,752 acres ÷ median CUA of 20.3 acres per bat = 86.3 bats).

Auwahi's habitat restoration, enhancement and management measures for the 1,752 acres ensure that the benefits to bats of the Tier 4 mitigation package will be substantially greater than only acreage-based land preservation. These additional Tier 4 mitigation measures were developed to maximize the benefit to bats and increase connectivity to other nearby protected parcels containing bat habitat. The combination of hedgerows, water features, and grazed areas creates a concentration of optimal foraging resources, documented in numerous studies to increase bat activity. Bats are likely to overlap in the use of the Mitigation Area; the mitigation actions in Tier 4 target foraging resources, and foraging ranges are known to overlap (Bonaccorso et al. 2015, Bellwood and Fullard 1984). Hawaiian hoary bats are likely to have a roost outside the Mitigation Area, suggesting less than 20.3 acres per CUA will be utilized within the Mitigation Area. Bat capture rates increase by a factor of 3.3 for every 6.21 miles of additional edge (Duff and Morrell 2007). Applying this metric linearly, the new edge habitat in the Mitigation Area should increase bat capture rates by a factor of 12 or more. This is

[11] "We have determined the HWA [Helemano Wilderness Area] project continues to meet FWS guidance and the benefits of the project are anticipated to offset, at a minimum, the take of 55 bats (Tier 4) based on a median male bat core use area of 20.3 acres." (USFWS 2018).
"We concur with the USFWS . . . that mitigation credit for the Helemano Wilderness Area acquisition is properly assessed . . . Based on a median core use area of 20.3 acres per bat, this equates to a mitigation credit of at least 55 bats. We confirm that we agree with this method of calculating mitigation credit, including assessment based on the median bat core use area." (DOFAW 2018).

further evidence that the benefit of the Tier 4 mitigation package will far exceed the 60 bats necessary for the offset of take authorized in Tier 4.

Time is a key factor to consider when evaluating the impact of mitigation actions. The conservation easement will be permanent, and thus will protect the out-planted koa and other native tree species which are expected to last more than 50 years (regeneration of trees in the hedgerows will likely produce much longer benefits). Similarly, the newly installed water features, and removal of barbed wire will last well beyond the permit term. This will continue to provide new habitat benefits for five or more generations of bats, or a total of at least 300 bats. These measures will provide benefits to bats that will extend well beyond the term of the incidental take authorizations and accrue to multiple generations of bats.

Auwahi Wind's Tier 4 mitigation provides additional benefits to bats by reducing three known risks to bats: removing barbed wire, adding wildlife egress structures to water troughs, and providing new water sources for preventing wildfires. Hawaiian hoary bats are documented to have been snagged on barbed wire; barbed wire removal within the mitigation area increases the bats survivability. Hawaiian hoary bats have been documented to drown in pools, and therefore installation of wildlife egress structures reduces the likelihood of that occurring. Furthermore, to reduce the potential for wild fires which can destroy habitat, Auwahi Wind is creating new ponds to be used as dip tanks to prevent fires within and adjacent to the Mitigation Area. These new year-round water sources will increase the chances of preventing devastating fires such as the destructive 2,300-acre fire that occurred in the adjacent Kula Forest Reserve in 2007.

The Tier 4 package also includes several research elements. Auwahi Wind's Tier 4 mitigation provides a research-quality monitoring regime that exceeds what is necessary to demonstrate compliance. Mitigation monitoring incorporates: 1) thermal video for bat behavioral studies, 2) insect (i.e., prey) assessment, and 3) an extensive acoustic monitoring protocol to provide valuable insight into bat life history, habitat needs, and responses to management actions. Additionally, Auwahi Wind will also conduct a single-year occupancy study of the Hawaiian hoary bat on Leeward Haleakalā as described in Section 6.2.3. These studies enhance the benefits that land preservation and habitat management (described above) provide to the bat and are critical to the recovery of the species.

In addition to the biological demonstration of benefits outlined above, the Tier 4 mitigation meets and exceeds the bat mitigation recommendations in the ESRC Bat Guidance (DOFAW 2015). The purpose of the ESRC Bat Guidance is "to develop cohesive, consistent guidelines for project proponents attempting to avoid, minimize, and mitigate for incidental bat take, and for the regulators tasked with overseeing those projects." The ESRC Bat Guidance first "suggests that an appropriate estimated cost for mitigation take of one bat is $50,000. This may be applied to different types of mitigation options outlined below. . . ." The Guidance then presents three mitigation options:

1. Habitat Management (forest restoration or wetland restoration). The Guidance states that forest restoration mitigation projects should be calculated based on a rate of 40 acres per bat.

2. Land Acquisition. The Guidance states that land acquisition "provides benefits when the acquisition safeguards the land from future development, protects existing habitat, or provides an opportunity for restoration/creation of habitat." The Guidance does not recommend any specific amount of per-bat mitigation acreage. Instead, the Guidance states that "Larger parcels are typically preferable to smaller parcels. However, the location of a smaller parcel (e.g., adjacent to another larger area that supports bats or is being restored to support bats) could make it more attractive as a mitigation site." The Guidance goes on to say that Land acquisition proposals will be evaluated based on the following factors: acquisition alone or acquisition plus a management plan, current status of and threats to the parcel, size of parcel, and whether the acquisition and preservation will be in perpetuity.

3. Research. The Guidance states that research "is not generally a preferred mitigation strategy" but can be used where research "can enable better management of the species." "In order for research to be credited as mitigation, research projects should be targeted to provide information on better management actions for the Hawaiian hoary bat that will lead to increasing the recovery of the species." The Guidance then identifies specific research priorities.

The estimated cost of Auwahi's multi-faceted Tier 4 mitigation package is approximately $63,700 per bat (Appendix I, including adaptive management), which exceeds the ESRC's recommended $50,000 benchmark by more than 27%. Auwahi has applied that cost mainly to the land acquisition and habitat management mitigation options, as detailed above, consistent with the ESRC Bat Guidance.

The amount and types of multi-faceted mitigation measures included in the Tier 4 mitigation package provide reasonable certainty that the mitigation will provide a net benefit to bats and increase the likelihood of the species' recovery. This reasonable certainty is further supported by the very conservative nature of the underlying take estimates. As explained previously, take is estimated using the 80-percent credible limit, and estimates of mortality are increased relative to estimates at the 50-percent credible limit (Appendix H). Take estimates assume all females taken between April 1 and September 15 have dependent young, and that all young lost as a result of Project operation would have survived to adulthood. These conservative assumptions thereby purposefully overestimate likely impacts to the bat. By fully mitigating for this likely overestimate of take impacts, the level of certainty regarding the effectiveness of the mitigation package is greatly increased.

In summary, the mitigation actions will lead to permanent protection of and substantial increases in the use of the Mitigation Area by Hawaiian hoary bats resulting in an overall significant net benefit to the species and increasing the likelihood of recovery. As identified above, benefits of the Tier 4 mitigation package include:

- Providing a multi-faceted mitigation plan that includes land acquisition, bat-focused habitat management, and research;
- Permanently protecting and preserving 1,752 acres of bat habitat;

- Increasing bat foraging and night roost habitat through enhancements of pastures with new hedgerows of native canopy and understory species;
- Creating additional water sources in new ponds, adding year-round water availability;
- Enhancing connectivity to other State reserve areas provided by the Mitigation Area's location;
- Benefiting multiple generations of bats over the life of the permit and beyond;
- Removing barbed wire that is a supplemental benefit to generations of bats that extend beyond the term of the incidental take authorizations;
- Increasing the survivability of bats with installation of water egress structures;
- Reducing the risk of wildfires with installation of new ponds with benefits that extend beyond the term of the incidental take authorizations;
- Implementing a research-quality monitoring regime which will provide valuable insight into the behavior, prey, life history, habitat needs, and responses to management actions;
- Providing critical research into the landscape level occupancy and distribution of the Hawaiian hoary bat, identified by the ESRC to be necessary for the recovery of the species;
- Consistency with the ESRC Bat Guidance which states "… the ESRC suggests that an appropriate estimated cost for mitigating take of one bat is $50,000" (DOFAW 2015). The Tier 4 mitigation estimated cost is $63,700 per bat (Appendix I); and
- Reducing the uncertainty in how to manage lands for bats.

6.2.4.4 Measures of Success

Because the Hawaiian hoary bat is a solitary tree roosting species, monitoring can be difficult. Tools for assessing feeding in a given area have been identified to assess the impacts of mitigation. Efforts at proxy measurements have focused on acoustic monitoring of bat activity, and evaluating calls has been recommended by Hawaiian hoary bat research (Gorresen et al. 2018, Todd 2012). Additionally, overall population trends and habitat occupancy on Maui have not been studied and such a baseline may take years to determine.

Auwahi Wind has developed success criteria to ensure that the objectives of protecting and enhancing bat foraging and roosting habitat are being met. Additionally, the monitoring (see Section 6.2.4.5) is designed to determine the overall trends in calls for the site.

Success criteria:

- Protect the mitigation parcel in perpetuity through a conservation easement including protections outlined in Section 6.2.4.2 with oversight of the parcel by HILT (or other appropriate conservation entity).

- Install two additional ponds in the Mitigation Area according to this management plan, or other number as specified through adaptive management.
- Increase forest cover to 20 percent within the pasture parcels through hedgerow reforestation at approximately 200 trees per acre, or other cover and parcels as specified through adaptive management.
- Record an increase in bat activity through acoustic monitoring over the baseline monitoring year(s), see Monitoring below. The statistical power with which the increase is recorded will also be reported.
- Summarize and report the results of monitoring (Section 6.2.4.5) in annual reports.

Long-term success criteria:

- Ensure mitigation parcel is managed according to the conditions within the conservation easement including protections outlined in Section 6.2.4.2 with oversight of the parcel protection by HILT (or other applicable entity).

6.2.4.5 Monitoring

As identified above, the current tools available to monitor for Hawaiian hoary bats are limited, which limits the ability to determine population size and population effects after implementation of management actions. The common methods for monitoring bats are acoustic monitoring, thermography, radio tracking, and mark-recapture. Acoustic monitoring has been most widely used, but recent studies (Gorresen et al. 2017) have shown that a bat may traverse acoustic detectors without calling, thereby causing underestimation of bat activity in the monitored area. The acoustic detectors also cannot provide counts of individuals. Therefore, acoustic monitoring is most suitable for long-term or spatially distributed studies. Thermography is both expensive to implement and has the limitation of being directionally focused, limited in focal depth, and unable to differentiate if bats are transiting the area or foraging. Thermography is valuable for specific applications, such as behavior monitoring. Mark-recapture studies are a traditional tool used for estimating population sizes. Bats have been difficult to capture, and recapture of bats are rare; for this reason no population-level mark recapture studies have been performed to date. Furthermore, GPS transmitter technology is not yet sufficiently light (less than 5 percent of body mass, or 0.4 grams) to be used on a Hawaiian hoary bat. Site-specific considerations also have implications for study design. Prior studies attempting to utilize radio tracking in the Mitigation Area were precluded by the unsuitability of the site due to electromagnetic interference from nearby transmission sources and USGS recommended no further telemetry studies there (Auwahi Wind 2017).

The primary monitoring success criteria will be to discern an increase in bat activity at the site. Secondary goals include determining the impacts of management actions and verification that management actions are consistent with the management program. Overall, the ability to estimate the actual bat population is limited by the available tools, and determining population size and population impacts have been difficult to discern. The management actions target increasing foraging habitat; therefore, using acoustic monitoring to monitor calls is proposed as the most appropriate tool to assess the impacts of the management.

Acoustic Monitoring

Acoustic monitoring will be the primary means of assessing the bat utilization at the Mitigation Area. Increasing foraging at the Mitigation Area is an essential part of the objective for the proposed Tier 4 Mitigation. The total number of calls will be documented. Acoustic monitoring provides information on the level of use or activity. Areas with greater levels of acoustic activity are assumed to provide better habitat than sites with lower activity (Frick 2013). The inclusion of all calls, rather than specifying call types (i.e., feeding buzzes) is supported by recent literature which notes the lower amplitude of feeding buzzes makes them more difficult to detect, and the monitoring of all calls is an appropriate measure of abundance (Gorresen et al. 2018).

Acoustic detectors[12] will be placed across the Mitigation Area at 10 sampling locations targeting each sub-habitat: open grasslands, forest edges (hedgerows or otherwise), and water troughs, for a minimum of 30 detectors plus one acoustic detector at each pond (the number of sampling locations is subject to change after power analysis). An additional ten locations will be identified across the landscape. At these ten locations, up to five additional detectors will be selected annually to collect monitoring data. Baseline monitoring will also be conducted at up to five locations outside of the Mitigation Area (exterior detectors) in appropriate similar habitat. The exact location of detectors will be selected from a grid of 328 x 328-foot cells overlaid on the site. The cells will be selected with generalized random tessellation stratified sampling. The random selection process will identify cells containing suitable sampling locations and the first ten suitable sites of each type will be selected. An approximation of the distribution of monitoring locations is detailed in Figure 6-7. Current acoustic detectors have an approximate detection radius of 30 feet. Detectors sited at water sources will be less than 30 feet from the water source to capture bat activity associated with troughs and ponds. Detectors at forest edges will be placed 30 feet from the forest edge to capture the anticipated peak in activity between zero and 60 feet from the forest edge.

Several potential confounding factors may influence the acoustic detections at exterior detectors including:

1. The flight distance of Hawaiian hoary bats is up to 7 miles, and it is not known how far the effects of the mitigation actions will impact the utilization of the surrounding area;
2. The climate conditions change significantly less than 0.5 miles to the east of the Mitigation Area as the topography transitions to the leeward side of the island;

[12] Detector selection will be based on the current industry standard. Changes in detectors will be minimized, documented, and for a change in detectors, a comparison of the two will be documented, ideally being a period of overlap that would allow direct comparison of results.

3. Changes in elevation in the area also bring significant differences in habitat conditions; and
4. The land use can significantly alter the habitat. Nearby residential, or forest parcels may not be suitable for comparison with pasture lands.

The exterior detectors will therefore be used for reference but will not be used to evaluate success criteria.

The detectors will be checked quarterly to download data and ensure the detectors are working properly. Additionally, the following data will be recorded for each detector at each data collection:

- Detector status;
- Nearest water source (pond or trough);
- Distance to nearest water source;
- Habitat type (grassland or edge);
- Distance to nearest forest edge;
- Classification of nearest forest edge:
    - Low Hedgerow (less than 10 feet tall);
    - Hedgerow (more than 10 feet tall); and
    - Forest (mature forest found in adjacent forest reserve or several stands in Waihou)'
- Presence or absence of cattle within the pasture where the detector is placed[13]; and
- Notes.

Monitoring data prior to the installation of water features will serve as the baseline period for the number of calls. Acoustic monitoring will occur year-round for the baseline period, after which a power analysis will be conducted to determine the number of detectors and the timing of deployment. Baseline monitoring will occur for at least one year.

The number of calls will be the primary tool to evaluate the success of management actions. An active detector night is when the acoustic detector remains active for more than half of the hours from sunset to sunrise. Each detector will be evaluated for active detector nights, thus 1 night with 30 active detectors is 30 active detector nights. The number of calls will be evaluated and compared to the location of water features and hedgerows that have been installed. Two metrics will be evaluated: 1) the call abundance (total number of calls recorded per active detector night), and 2) call nightly detection (proportion of total active detector nights with calls).

$$Call\ Abundance = \frac{Total\ calls}{Total\ active\ nights}$$

[13] May be supplemented with Ranch records.

$$Call\ Nightly\ Detection = \frac{Total\ nights\ with\ calls}{Total\ active\ nights}$$

An increase in average calls is expected in the monitoring year following the year(s) in which pond installations are completed. The overall probability of calls will be evaluated per habitat type to provide insight into the impacts of the individual and combined effects of the variables: open pasture, forest edge, trough, pond, and presence or absence of cattle.

The data will be analyzed after years 0, 1, 2, 3, 5, 7, 9, and 11. Data analysis will compare the covariates of ponds, and hedgerows to determine the impacts of each management action and the overall abundance and detectability at the site. The results of this analysis will be summarized in the annual report following the completion of each year.

Power Analysis

Following the first year of data collection, call abundance and call nightly detection will be analyzed to determine if it varied by factors such as distance to nearest water source, habitat type, and distance to nearest forest edge. These data will then be used in a power analysis to estimate the probability of detecting increases in calls of different magnitudes with different numbers of detectors. The factors that were found to be important in the initial analysis as well as the variability encountered will inform the structure of the power analysis.

Under each scenario, the number of calls will be increased for each site based on a given percent increase and with a given variability in the response. The data will be analyzed and the significance level for the year (pre and post) variable will be recorded. This process will be repeated several thousand times and the proportion of simulations with a p-value less than or equal to 0.05 will be the estimate of the power to detect a difference for that increase in calls. The number of sites included can be varied to determine how the power to detect an increase in calls changes in response to sample size.

Potential scenarios to evaluate include:

- A 50, 100, or 150 percent increase in call abundance at all sites;
- The increase in call frequency varies by habitat type;
- The increase in call frequency varies by month or season; and
- Low, medium, or high variability in response among sites.

As a result of the power analysis, the number of acoustic detectors or sampling regime may be reduced by Auwahi Wind when there is sufficient power to detect a 50 percent change in occupancy across the site with a power of 0.5 or greater. The results of the power analysis and resulting changes to the monitoring protocol will be reported to the USFWS and DOFAW and recorded in the annual report.

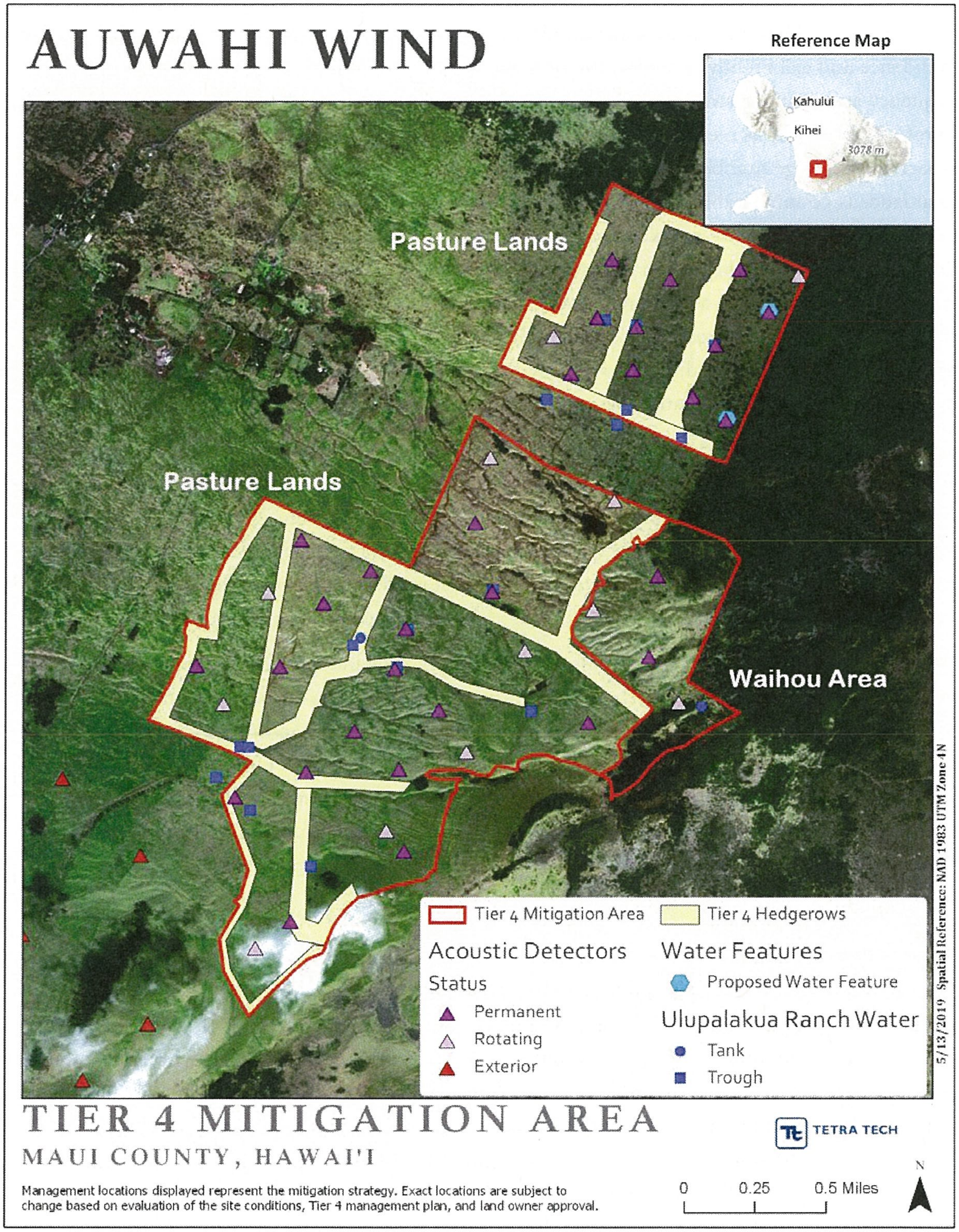


Figure 6-7. Locations of Acoustic Detectors Relative to Management Actions

Data Analysis

The data collected during the acoustic monitoring portion of this study will be summarized as call abundance and call nightly detection for each site during each month as described previously. The frequency and spatial distribution of call occurrence will not be known until data collection begins; therefore, data analysis methods may need to be modified if these values differ greatly from expected (e.g., large number of sites with no calls recorded or calls recorded every night). Call abundance is count variable and call nightly detection is a proportion, but both can be analyzed within the generalized linear mixed model framework. Count data can be modeled with a Poisson distribution or, if over-dispersion is observed, a negative binomial model can be used. The proportion of nights with a call can be modeled as a binomial distribution that models the number of successes during some number of trials. The results from each monitoring location will be autocorrelated and results adjusted to include location as a random variable. The power will likely be increased by comparing pre- and post- changes for each location directly.

This analysis provides flexibility for different data types and additional complexity of the model. If a substantial portion of monitoring locations have no calls recorded, a more complex zero-inflated model could be considered. Competing models can be compared using Akaike information criterion (AIC) values (Akaike 1973). AIC is a quantitative comparison of models and provides a means of model selection. Models within 2 AIC units of the best model will be considered to have some support (Burnham and Anderson 2002) and model averaged parameter values could be calculated.

This model framework treats monitoring locations as spatially independent. Acoustic monitors will be distributed widely to minimize the spatial autocorrelation among adjacent monitors. The 1,752 acres within the Mitigation Area could support 86 bat CUAs of 20.3 acres each, therefore 30-40 monitors widely dispersed could be largely independent. If large spatial correlation is suspected, analysis methods to take this into account can be considered (Dormann et al. 2007). The results of this study could also be influenced by changes in the overall bat population on the island. The data from acoustic monitors outside of the Mitigation Area will be analyzed to attempt to assess bat trends independent of the mitigation measures.

Percent Forest Cover

Optimal forest cover as documented by Jantzen (2012) is 20 to 25 percent cover of the parcel to optimize hoary bat utilization of the site. The percent cover of the parcel will be assessed through GIS analysis. The perimeter of each forested area will be traversed and recorded via GPS to generate a polygon. All woody vegetation with an apical stem greater than 10 feet in height will be included to assess the total vegetated area. The perimeter of the outer branches will determine the boundary. Continuity of forest will be determined by separation of tree base and height of apical stems, separation of the base of trees is not to exceed 22 feet (diagonal distance estimated by 15-foot spacing). Percent forest cover will be reported in monitoring years after year five. If any monitoring period shows the forest cover is below 20 percent, Auwahi Wind will replant trees necessary to bring the forest cover up to 20 percent. Auwahi Wind may first error check and/or resample the

Mitigation Area within three months to ensure that any measurement that does not meet success criteria was not the result of seasonal variation or inconsistencies in the data collection method. In any year when aerial imagery was taken for the Mitigation Area, GIS analysis of the aerial imagery may be substituted for a field survey of the perimeter.

Thermal Videography

Auwahi Wind will use thermal cameras to document the behavior of bats at ponds and/or water troughs. The effort and duration of monitoring will be determined by Auwahi Wind. The results of the monitoring will be reported in the annual report.

Insect Monitoring

Auwahi Wind will conduct quarterly insect monitoring for the baseline monitoring period for each of the following substrates: pond, future hedgerow location, and pasture. Following the baseline monitoring, semiannual (twice yearly) insect monitoring will be conducted in years 1, 2, 3, 5, 7, 9, and 11. Monitoring will consist of one malaise trap set-up for 1 month at each of the three locations. Following the sampling the lepidopteran and coleopterans will be identified and the abundance of each order (for insects over 10 mm) will be reported in the annual report.

Pond Monitoring

The ponds within the Mitigation Area will be checked quarterly to ensure they are operating correctly. Should repairs be required they will be made as soon as is practicable and before the next quarterly check.

Other Monitoring

Other monitoring may be added to the monitoring protocol if is determined that the monitoring outlined above is not sufficient to determine the response of Hawaiian hoary bats to the mitigation actions.

6.2.4.6 Reporting

The success criteria will be the primary metrics for analysis. Auwahi Wind will include in the annual report a summary of the data by year, including the baseline monitoring year. Specifically, Auwahi Wind will include:

- The date the conservation easement was recorded, and annual inspection records if available from HILT;
- Photos of existing ponds and created ponds;
- A summary of acoustic monitoring data and a comparison to the baseline monitoring year, including the statistical power with which any change is documented. The results of the generalized linear mixed modeling including the AIC of all models;
- The percent forest cover and a summary of the analysis;

- A summary of insect assessment, by season and year, and a comparison to acoustic monitoring results;
- A qualitative report of behavior documented for all periods when thermal imagery was recorded. An evaluation of the total number of observations documented and a comparison to the level of effort;
- Any adaptive management actions taken; and
- Any additional pertinent summary information needed to provide a full picture of mitigation actions.

6.2.4.7 Adaptive Management

Because the benefit of each of the mitigation actions are likely to vary, adaptive management will be an essential component of the HCP and the Tier 4 Mitigation. All initial mitigation actions will be evaluated against the success criteria in years 5, 7, 9, and 11 of the HCP Amendment. Each evaluation will be an opportunity for adaptive management to be triggered. Triggering of any adaptive management will also trigger monitoring for the next 2-year interval to ensure that success criteria are met.

The following triggers for success criteria and adaptive management are based on the evaluation of management actions described below. These triggers include:

- If either the call abundance or call nightly detection is doubled or greater, relative to baseline monitoring, no adaptive management actions will be necessary;
- Adaptive management will be triggered if both call abundance and call nightly detection are less than or equal to the baseline; and
- Adaptive management may be triggered if either call abundance or call nightly detection are less than or equal to the baseline. If either the call abundance or call nightly detection is equal to or less than the baseline, and the other variable is not doubled or greater, adaptive management will be triggered.

If adaptive management is triggered, Auwahi Wind will also assess the insect composition relative to the baseline conditions. If the insect monitoring does not show that species needed for bat foraging are present (principally moths and beetles, or other species documented through diet analysis of the Hawaiian hoary bat), Auwahi Wind will either[14]:

1. Change the species composition or replace trees that have not survived with new canopy species shown to support Hawaiian hoary bat foraging; or

[14] Auwahi Wind may initiate either action earlier than the triggering of adaptive management. The initiation of these actions prior to adaptive management triggers will be considered adaptive management.

2. Supplement the understory species within the hedgerows with a minimum of 5,000 individuals of a native plant species shown to support Hawaiian hoary bat foraging.

Modification of Management Actions

The goal of adaptive management actions is to collect data on the effectiveness of the management actions and respond with measures that are shown to be effective at having a positive influence on success criteria. As there is uncertainty in the response of Hawaiian hoary bats to the management actions, Auwahi Wind has a number of options available for modifying the proposed management actions including:

1. Additional ponds;
2. Additional hedgerows;
3. Reforestation at higher densities within the Waihou parcel;
4. Alteration of canopy species; and
5. Alteration of understory species.

By having a selection of options for future adaptive management, Auwahi Wind avoids implementing management actions that do not positively impact the Hawaiian hoary bat population and prioritizes management actions that are correlated with increased Hawaiian hoary bat activity. If adaptive management is triggered, modifications to the proposed management actions (described below, summarized in Table 6-1) will be implemented.

The adaptive management action will be determined from the monitoring response of the prior management actions implemented. A maximum impact for each of the management actions implemented is assumed but that maximum is not known. To determine if management actions are positive, the measurement of distance to features will be used to conduct a generalized linear mixed model, selecting multiple input models. The model with the lowest AIC value will be selected to determine which covariates provide the greatest prediction of bat activity. If no significance can be determined, the data will also be summarized for trends. A map of the scale of results will also be produced to determine if there are geographic trends. Therefore, the impact of the prior management actions will be compared, and the management action (either hedgerows or water features) that elicited a greater response will be implemented for adaptive management. If both hedgerows and water features have a similar response, hedgerows will be prioritized for years 5 and 7 so that the impact may be realized within the permit term. Water features will be prioritized in years 9 and 11 given that their impact will be realized quickly.

Reforestation of Hedgerows

Through adaptive management, Auwahi Wind seeks to provide habitat that would ensure the needs of the Hawaiian hoary bat are met. Through adaptive management, Auwahi Wind will target the Waihou parcels for higher levels of reforestation.

Three opportunities for adaptive management with respect to reforestation occur with one each in years 5, 7, and 9 (Figure 6-6). Reforestation actions taken in year 11 of the HCP Amendment would be unlikely to have impacts on the success criteria within the remaining years of the permit term, and thus are not included. Each step of adaptive management will be implemented successively. Therefore, if step one is not implemented at year 5, and adaptive management is triggered in year 7, step one will be implemented in year 7.

1. First step of adaptive management for hedgerows:

If additional reforestation actions are triggered at the initial evaluation of success criteria, reforestation of the Waihou Area parcels of Cornwell, Kaumea Loco, and Duck Ponds will be implemented. Initial efforts to reforest these sites will increase the forest cover in the Waihou Area to 40 percent in Figure 6-6 (79.2 acres of forest). Reforestation at 40 percent of total cover within 1.5 miles of study sites represents an increased use rate observed for hoary bats (Jantzen 2012).

2. Second step of adaptive management for hedgerows:

If additional reforestation actions are triggered, hedgerows within the pasture lands will be increased so that total cover will be increased to 25 percent within the Pasture parcel, or an additional 78 acres of hedgerows. Target sites will be selected to optimize habitat connectivity, as well as maximize the opportunity for bat use. The siting of additional hedgerows will consider the past out-planting success, the call abundance and call nightly detection in similar site conditions, the connectivity to other habitat features utilized by the Hawaiian hoary bat, and the logistics of site management.

3. Third step of adaptive management for hedgerows:

If additional reforestation actions are triggered, the forest cover will be increased to 70 percent of the area within the Waihou Area or 59.4 additional acres of reforested area (Figure 6-6; Jantzen 2012). Increasing forest cover to 70 percent cover represents the second peak observed in the activity of hoary bats.

Table 6-1. Management Actions by Parcel: Baseline and Proposed

Parcel	Acreage	Land Cover	Baseline	Initial Reforestation	Adaptive Management
Pasture	1,198	Forest	0%	20%	25% (Step 2)
Waihou	198	Forest	25%	25% (unchanged)	40% (Step 1) and 70% (Step 3)

Ponds

Adaptive management will be evaluated at four intervals: Years 5, 7, 9, and 11. If new ponds are determined to be necessary through adaptive management, the evaluation of ponds will compare the call abundance of the added ponds. The siting of such features will take into consideration the existing water features, the distance to existing water lines, and the nearness to roosting habitat.

Alternative Management Actions

If neither reforestation of hedgerows or the addition of ponds is indicated, Auwahi Wind will work with USFWS and DOFAW to identify appropriate alternative actions based on the monitoring data.

Water Availability

If the quarterly monitoring of ponds finds that they are consistently (three consecutive quarters, or the same quarter for three years) not supplied with sufficient water to keep them full, Auwahi Wind will investigate the cause and rectify the problem. Such resolutions may include (depending on the source of the problem): repair of structure or liner, securing alternative sustainable sources of water (such as known springs or catchment systems), alteration of the system to provide additional resilience, or other methods to maintain the water sources.

Monitoring

The monitoring plan may be adjusted based on the result of the power analysis and updated in subsequent years if assumptions are found to be incorrect.

Any change to monitoring will be reported to the USFWS and DOFAW, and noted in the annual report.

6.2.4.8 Timeline

There is an immediate need for action to mitigate the impacts of taking Hawaiian hoary bats at the Project. Auwahi Wind will begin mitigation actions upon issuance of the amended ITP/ITL. Auwahi Wind will provide a copy of the easement to DOFAW and USFWS within 30 days of ITP/ITL issuance. Agencies will review or respond within 30 days or the form of the easement shall be deemed acceptable.

Baseline monitoring is important to documenting changes to the landscape and demonstrating that success criteria are met. Logistical needs for implementation are expected to take approximately one year to complete including the installation of water trough egress structures, installation of ponds, hedgerow fence installation, and other infrastructure improvements. Auwahi Wind will use the time required for infrastructure improvement to conduct baseline monitoring. The timeline of actions is outlined below in Table 6-2.

Table 6-2. Timeline for Actions to be Implemented

HCP Amendment Year	Actions	Evaluation
0	• Parcel protected through conservation easement • Baseline monitoring conducted • Infrastructure improvements: water line installation, fencing, water trough egress installation, and pond installation to begin • Quarterly Insect Monitoring	• Conservation easement recorded • Baseline monitoring conducted • Management actions implemented
1	• Continued infrastructure improvements: continuation of year 0 actions	• Acoustic monitoring occurring at water troughs and ponds and pasture lands

HCP Amendment Year	Actions	Evaluation
	• Completion of installation of ponds, all water features filled according to management plan • Initial reforestation of hedgerows • Power analysis for acoustic detectors • Acoustic monitoring • Semiannual Insect Monitoring • Thermal videography behavioral monitoring at water troughs and ponds • Quarterly water pond inspection	
2 and 3	• Continued infrastructure improvements from years 0 and 1 • Replanting of hedgerows to replace losses • Fence maintenance • Acoustic monitoring • Semiannual Insect Monitoring • Quarterly water pond inspection	• Acoustic monitoring occurring at water troughs, pasture lands, and hedgerows • Hedgerows out-planted cover 20% of the Mitigation Area at 15-ft spacing, with average height less than 5 ft
5	• Fence and infrastructure maintenance • Acoustic monitoring • **Evaluation of monitoring to determine the need for adaptive management to meet success criteria** • If warranted: adaptive management actions as specified by the adaptive management plan • Semiannual Insect Monitoring • Quarterly water pond inspection	• Acoustic monitoring occurring at water troughs, pasture lands, and hedgerows • Evaluation of success criteria.
7	• Fence and infrastructure maintenance • Acoustic monitoring • **Evaluation of monitoring to determine the need for adaptive management to meet success criteria** • If warranted: adaptive management actions as specified by the adaptive management plan • Semiannual Insect Monitoring • Quarterly pond inspection	• Acoustic monitoring occurring at water troughs, pasture lands, and hedgerows • Evaluation of success criteria
9	• Fence and infrastructure maintenance • Acoustic monitoring • **Evaluation of monitoring to determine the need for adaptive management to meet success criteria** • If warranted: adaptive management actions as specified by the adaptive management plan • Semiannual Insect Monitoring • Quarterly pond inspection	• Acoustic monitoring occurring at water troughs, pasture lands, and hedgerows • Evaluation of success criteria
11	• Fence and infrastructure maintenance • Acoustic monitoring • **If success criteria are not met in year 9, evaluate monitoring results to determine the need for adaptive management** • If warranted: adaptive management actions as specified by the adaptive management plan • Semiannual Insect Monitoring • Quarterly pond inspection	• Acoustic monitoring occurring at water troughs, pasture lands, and hedgerows • Evaluation of success criteria

6.2.5 Tier 5 and Tier 6 Mitigation

Auwahi Wind has identified land restoration/management as the primary type of mitigation for Tiers 5 and 6, to enhance bat foraging and roosting habitat and provide an overall benefit to the species. Tier 5 and 6 mitigation is based on criteria similar to that used for Tier 4 mitigation, and targets many of the same management goals and actions known to have positive benefits for bats, as previously described in Sections 3.8.1 and 6.2.4. Tier 5 and 6 mitigation will be implemented in the Kamehamenui Forest/Von Tempsky Parcel (Kamehamenui Forest) located in east Maui. DOFAW recommended that Auwahi Wind consider conducting mitigation actions in the Kamehamenui Forest, which is proposed for DLNR acquisition, to mitigate for Tier 5 and 6 take levels of 34 and 25 bats, respectively. Auwahi Wind would improve 690 acres of habitat in Tier 5 and 508 acres in Tier 6 (see the Take Offset/Net Benefit section under Section 6.2.5.1 below), based on the median bat CUA size of 20.3 acres (DOFAW 2015).

Triggers for Mitigation

Planning for the next tier of mitigation will occur prior to reaching the amount of take authorized in the current tier. The triggers for initiating mitigation for Tiers 5 and 6 are described in Table 6-3 below. Mitigation planning for the next higher tier would be triggered by reaching 75 percent of allowed take in the current tier (direct and indirect), as outlined in guidance from USFWS (USFWS 2016b). Based on expectations of the effectiveness of LWSC, it is likely that Tiers 5 and 6 may not be reached until much later in the permit term, if at all (Section 5.1.1 provides information on the take estimation, and Appendix H provides details on the estimation process).

Table 6-3. Tiers 5 and 6 Triggers for Initiating Hawaiian Hoary Bat Mitigation

Trigger for Initiating Additional Mitigation[1]	Mitigation Tier Triggered
Cumulative Take Estimate > 66 bats	Tier 5
Cumulative Take Estimate > 106 bats	Tier 6

1. The EoA software will be used to calculate the 80 percent upper credible limit of cumulative direct take; the calculation of indirect take is described in Appendix H. If the 80 percent upper credible limit of cumulative take (direct + indirect) is reached, the tier will be triggered.

6.2.5.1 Kamehamenui Forest/Von Tempsky Parcel Project

The Kamehamenui Forest will serve as the mitigation area for the Auwahi Wind Tier 5 and 6 bat mitigation, should those tiers be triggered, as it provides a unique restoration opportunity that will benefit the Hawaiian hoary bat. DOFAW suggested the Kamehamenui Forest to Auwahi Wind as a desirable site to consider for bat mitigation (Fretz 2018, pers. comm.). Upon learning more about the parcel's characteristics and DOFAW's proposed management goals for the property, Auwahi Wind decided to move forward with the Kamehamenui Forest as its proposed Tier 5 and 6 mitigation area.

Site Description

The Kamehamenui Forest parcel is located on the north slopes of Haleakalā. It is approximately 3,400 acres and stretches from upper Kula (3,400 feet asl) to nearly the summit of Haleakalā (9,800 feet asl). Haleakalā National Park is adjacent to the parcel to the east, and the Kula Forest Reserve is adjacent to the parcel to the south (Figure 6-8). The upper elevations (>8,000 feet) are designated federal critical habitat for 10 rare plant and bird species. The lower elevations are primarily pasture lands that are well-suited for reforestation.

The DLNR is actively pursuing the acquisition of this land for incorporation into the State Forest Reserve system under the management of DOFAW. DLNR considers this parcel "strategically critical" for the Watershed Partnerships (USDA Forest Service 2018). DOFAW has prepared several documents about the property that describe 1) the benefits of protecting the parcel, 2) DOFAW's management goals, and 3) its process for preparing a detailed management plan that outlines proposed management actions to accomplish their goals for the parcel (USDA Forest Service 2018, DLNR n.d., BLNR 2019; compiled as Appendix J). DOFAW requested approval of the parcel acquisition from the Board of Land and Natural Resources (BLNR) on March 8, 2019 (BLNR 2019). The request for approval document, submitted to the BLNR, provides a detailed outline of DOFAW's plan for the parcel that includes management to benefit the Hawaiian hoary bat and calls out the compatibility of this parcel as mitigation for listed species. Pertinent excerpts from the DLNR (BLNR 2019) state:

> If acquired by the State, the intent is to add the Parcel [Kamehamenui Forest] to the Forest Reserve System. The division will develop a comprehensive multi-use management plan, guided by community and stakeholder input."
>
> "This project will protect the Property's ecosystems, including a native subalpine ecosystem in the upper elevations (>8000'[feet]), which are designated federal critical habitat for 10 rare plant and bird species. These areas are relatively intact and native species are expected to regenerate naturally once the area is protected from feral ungulates. These areas are expected to be important for species adaptation to climate change as habitats shift under changing conditions. Lower elevation portions of the property are well suited for reforestation with ecologically and economically valuable species such as koa (*Acacia koa*) and sandalwood (*Santalum haleakalae* var. *haleakalae*).

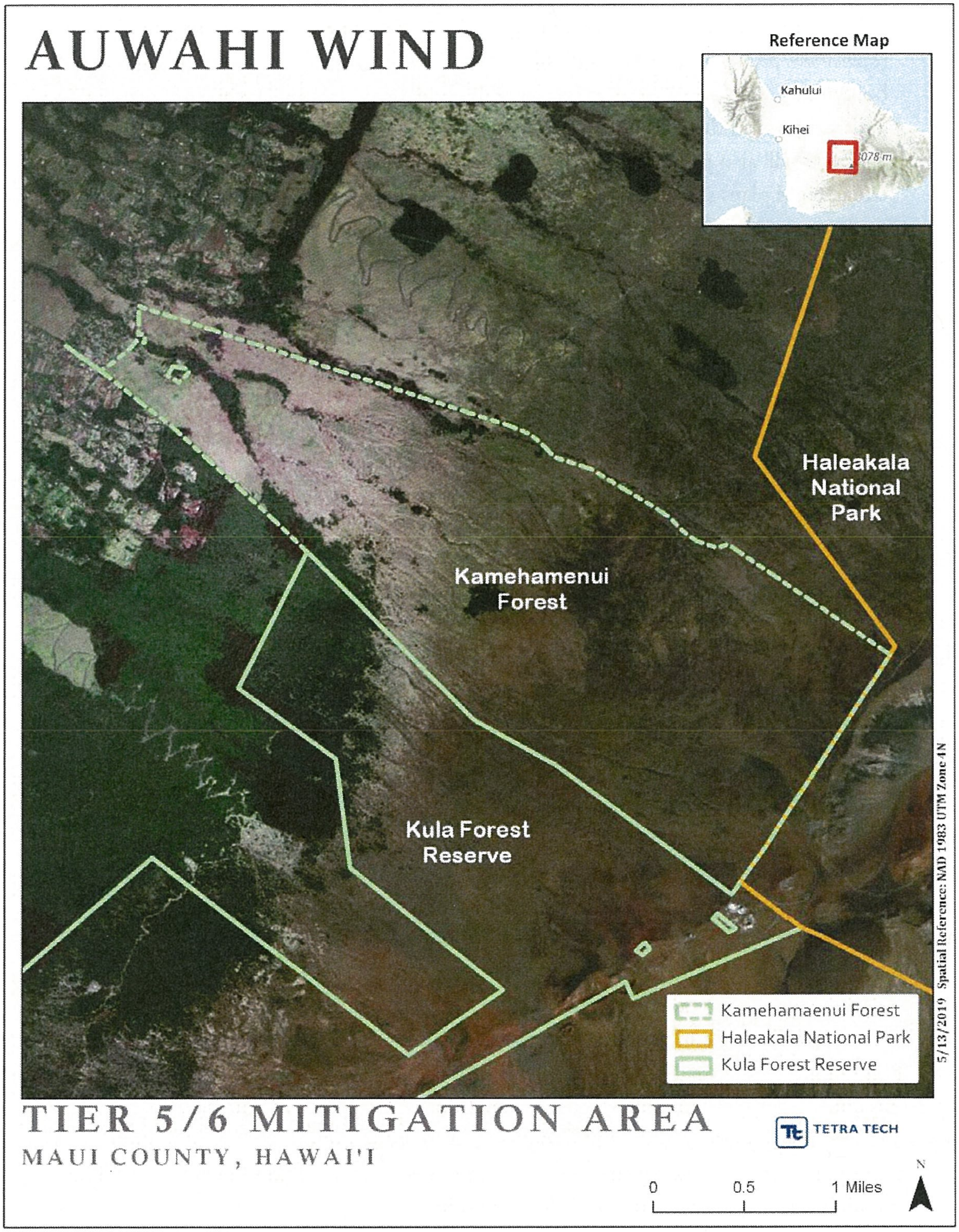


Figure 6-8. Location and Aerial Imagery of Kamehamenui Forest

> Once acquired, the Division is planning habitat management and habitat restoration to enhance recovery efforts for the endangered wildlife including the ʻuaʼu, or Hawaiian petrel (*Pterodroma phaeopygia sandwichensis*), nēnē or Hawaiian goose (*Branta sandvicensis*), Hawaiian hoary bat – ʻōpeʻapeʻa (*Lasirus cinereus semotus*), Maui Parrotbill – kiwikiu (*Pseudonestor xanthophrys*), and the crested honeycreeper – ʻākohekohe (*Palmeria dolei*). Acquisition of the Property will also provide additional outplanting and recovery sites for several critically endangered plant species including the ʻahinihina or Haleakalā silversword (*Argyoxiphium sandwicense* subsp. *macrocephalum*). These areas will be vital for species migration due to climate change.
>
> On the island of Maui, three wind energy complexes provide 72MW of power, but have also resulted in incidental take of the federally listed endangered uaʼu, nēnē, ʻōpeʻapeʻa, and Blackburn's sphinx moth (*Manduca blackburni*). Acquisition of the Kamehamenui Property will complement required mitigation being performed pursuant to the respective Habitat Conservation Plans for these species by protecting and restoring suitable habitat, managing threats, and increasing survival and reproductive success and contributing [to] the overall recovery of those species…

In addition to benefiting the Hawaiian hoary bat, improvement of the Kamehamenui Forest habitat is expected to provide other environmental and community benefits. DLNR has estimated that reforestation of the parcel is anticipated to increase the water collection in the Makawao aquifer from 3.4 million to 4.2 million gallons of water per day (DLNR n.d.). The native forest also provides carbon sequestration at a time when the impacts of greenhouse gases are of critical concern.

The DLNR acquisition and restoration of the Kamehamenui Forest provides an opportunity for future additional, complementary management actions by Auwahi Wind to mitigate impacts to the Hawaiian hoary bat. As identified above, DOFAW will develop a detailed management/restoration plan once the parcel is acquired, and several key management actions have been identified that, when completed, would benefit bats. The lower two-thirds of the parcel (2,233 acres) is pasture land (Figure 6-9) and is well-suited for reforestation due to its accessibility, precipitation, deep fertile soil, gentle slope, and proximity to other forests. The habitat improvements proposed by DOFAW are intended to increase the available roosting and foraging habitat for bats. Additionally, Hawaiian hoary bats have been noted to use gulches (C. Pinzari, pers. comm. 2018); Pinzari & Bonaccorso 2016; H.T. Harvey 2019), and the parcel contains several prominent gulches that could also provide priority habitat for the Hawaiian hoary bat. Hawaiian hoary bats have also been documented to use high elevation foraging grounds when inclement weather at low elevation reduces foraging opportunities (Bonaccorso et al. 2016). This aspect of Hawaiian hoary bat behavior increases the value of the parcel for bats (and other species), as the parcel spans a wide elevational gradient, providing high elevation habitat above the inversion layer.

Figure 6-9. Aerial Photo of the Current Conditions of the Kamehamenui Forest Parcel (photo credit: DLNR n.d.)

Hawaiian hoary bats have been documented near the Kamehamenui Forest parcel. Data from the Hawaiian Heritage Database, the USGS Bison database, and preliminary results from ESRC-approved research (H.T. Harvey 2019) have provided acoustic bat detection data collected to date. Hawaiian hoary bats have been documented at numerous locations surrounding the parcel, suggesting the Hawaiian hoary bat would likely be detected within the parcel. Figure 6-10 shows the documented bat occurrence in the surrounding parcels.

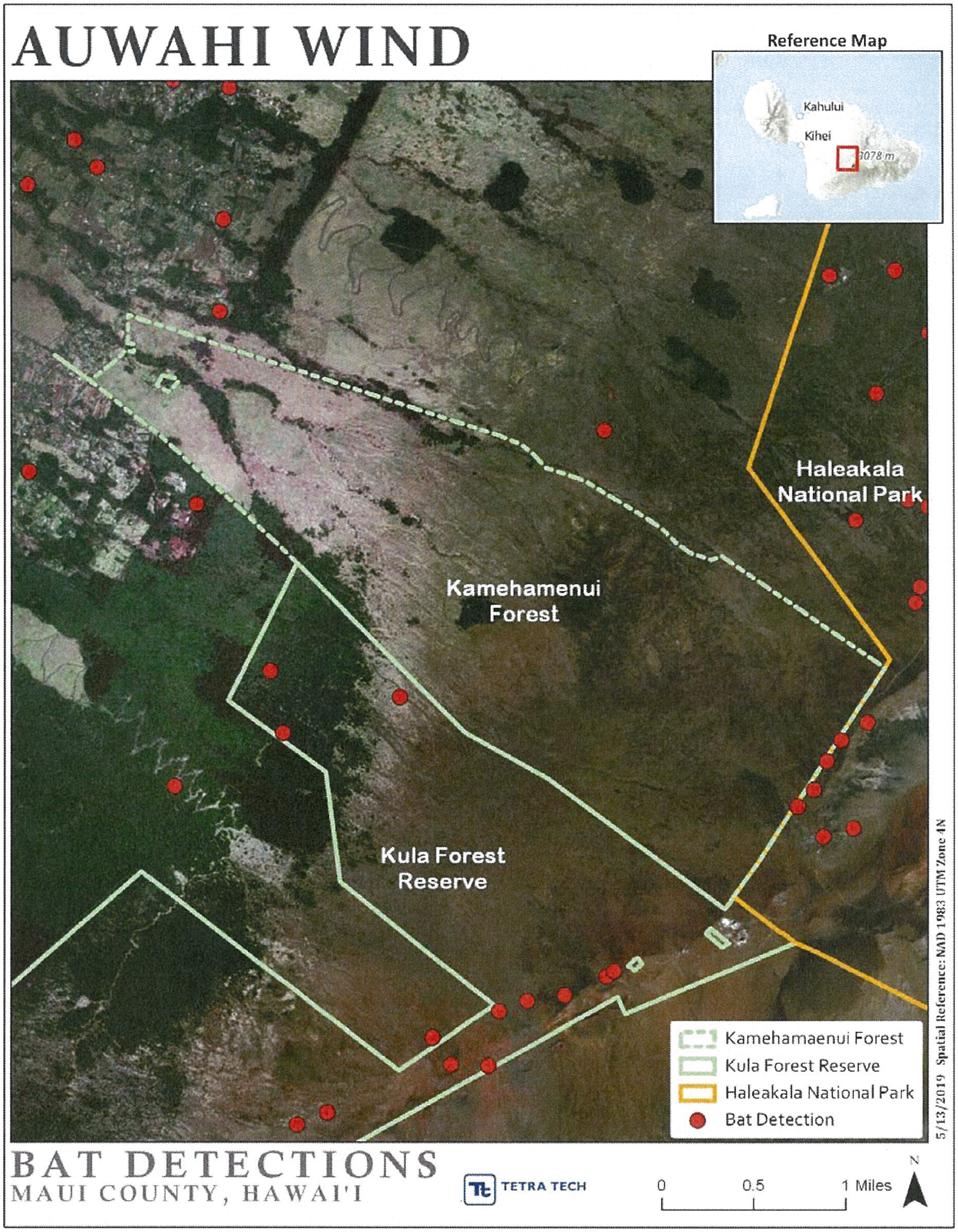


Figure 6-10. Bat Detections in the Vicinity of the Kamehamenui Forest

As described above and in the BLNR (2019) report (see Appendix J), DOFAW identified several management activities that would be incorporated into its management plan for Kamehamenui Forest. These management actions are compatible with Hawaiian hoary bat habitat needs as the bat is identified as a key species that would benefit from the acquisition (BLNR 2019, DLNR n.d.). The actions proposed by DOFAW include protection and creation of native habitat through fencing, removal of non-native ungulates and plants, and outplanting of koa and sandalwood (*Santalum haleakalae* var. *haleakalae*) While DOFAW intends to implement management actions itself over the long term, DOFAW anticipates that there will be opportunity for Auwahi Wind to also implement additional, complementary management actions on the parcel if Tier 5 and/or 6 are triggered.

Pre-Trigger, Baseline Monitoring

Before Tier 5 or 6 are triggered, preliminary baseline monitoring for the Hawaiian hoary bat will be conducted in the mitigation area. Auwahi Wind will collaborate with DOFAW to establish two acoustic monitoring locations to document parcel-specific Hawaiian hoary bat activity. This acoustic monitoring will confirm Hawaiian hoary bat occurrence in the parcel, provide expected activity rates, and inform seasonal fluctuations in activity at the mitigation site, and be used to perform a power analysis determine the power with which a change can be detected.

Early implementation of baseline monitoring will inform the development of Auwahi Wind's management plan. Before the pre-trigger, baseline acoustic monitoring can be initiated, the following conditions must be met: 1) Auwahi Wind must receive the amended ITP and ITL, 2) DOFAW has confirmed to Auwahi Wind in writing that the parcel has been acquired and ownership/management has been transferred to DLNR/DOFAW, and 3) Auwahi Wind has received the necessary permits and approvals to implement baseline monitoring within the parcel. Once these conditions are met, Auwahi Wind will begin preliminary baseline acoustic monitoring at the mitigation area within 3 months or as soon as is practicable. Auwahi Wind will conduct baseline acoustic monitoring for 2 years from the time the monitoring starts.

Tier 5 and 6 Mitigation Planning

As noted above, Tier 5 and 6 mitigation will likely not be triggered for many years, if ever. As a result, Auwahi Wind has identified the types of habitat management actions it would likely implement on the Kamehamenui Forest parcel for Tier 5 and 6 mitigation (discussed further below), which are compatible with the broader management goals identified by DOFAW. If Tier 5 or 6 is triggered, Auwahi Wind will then work with the USFWS and DOFAW to develop a Site-Specific Mitigation Implementation Plan (SSMIP) that is based on current information and circumstances. This will ensure that the SSMIP will complement management actions to benefit bats that DOFAW may have already initiated within the parcel. It will also be based on then-current baseline monitoring, which will be performed after DOFAW has secured ownership and management of the parcel. The SSMIP will be based on and reflect the best available science, new technological advances, and current agency guidance. For example, the SSMIP will be able to incorporate the latest results of Hawaiian hoary bat mitigation and research projects currently underway and thereby maximize the mitigation benefits.

The SSMIP will document then-current habitat conditions and deficiencies, and specify the management actions Auwahi Wind will implement to increase habitat suitability sufficiently to increase the parcel's bat carrying capacity and provide a net benefit for the species. The SSMIP must be reviewed and approved by USFWS and DOFAW prior to implementation.

The SSMIP will address the following topics in detail:

- Baseline habitat conditions;
- Specific location(s) of mitigation actions;
- Specific type(s) of mitigation actions;
- Timing of mitigation action implementation;
- Success criteria;
- Monitoring of mitigation implementation and success, and presence of Hawaiian hoary bat;
- Adaptive management;
- Demonstration of how the mitigation will offset take; and
- Cost estimates.

Once Tier 5 (or 6) is triggered, Auwahi Wind calculates that it will take between one and two years before the take estimate is equal to or greater than the incidental take authorized in the current tier (Section 6.2.6). This will provide ample time for Auwahi Wind to develop, and obtain USFWS and DOFAW approval of, the SSMIP. Auwahi Wind will submit its proposed SSMIP within 5 months of tier triggering.[15]

Proposed Auwahi Wind Management Actions

To expand upon the concepts identified by DOFAW in the acquisition proposals for Kamehamenui Forest, Auwahi Wind has identified specific management actions to enhance bat foraging and roosting habitat that it anticipates implementing for Tier 5 and 6 mitigation. The focus of these management actions will be to increase bat roosting, foraging habitat, and/or prey availability. One such action consists of the out-planting of native tree species, which will help build the vertical vegetative structure and canopy cover that is necessary for bat roosting. A heterogeneous vegetative structure provides shelter for insect species that are the prey for Hawaiian hoary bats, and preferred edge habitat for Hawaiian hoary bat foraging (Jantzen 2012, H.T. Harvey 2019). Another anticipated action is the creation of water features, which will also likely increase bat usage of the site, as noted in Section 6.2.4. Finally, Auwahi Wind anticipates removing invasive plant and animal species, which

[15] As discussed in Section 6.2.6, Auwahi Wind will submit its proposed SSMIP to the agencies within five months of the next tier being triggered.

can negatively affect the Hawaiian hoary bat habitat by reducing available roosting trees, competing with native species, decreasing vegetative diversity that affects prey availability or diversity, or predating or competing with bats (D'Antonio et al. 2011, DOFAW 2017, USDA 2019, Anderson 1999, Vanderwerf 2009, Bernard and Mautz 2016).

Auwahi Wind will coordinate with DOFAW once its "comprehensive multi-use management plan, guided by community and stakeholder input" is developed to ensure that Auwahi Wind's SSMIP is compatible (BLNR 2019). Additionally, in collaboration with DOFAW, Auwahi Wind may decide that the most appropriate bat mitigation at the time of triggering is to implement distinct portions of the DOFAW management plan. This will be fully described in the SSMIP, should Auwahi Wind decide that is the most prudent option based on the best available information.

Take Offset/Net Benefit

Should Tier 5 or Tier 6 be reached, Auwahi Wind will provide a net benefit to the species by implementing a mitigation program supported as critical to the recovery of the Hawaiian hoary bat by the available literature and agency guidance (see Section 6.2.4). The mitigation is based on the median CUA size of 20.3 acres (DOFAW 2015). The improvement of 20.3 acres is anticipated to offset the take of one bat based on the evaluation of core use area and agency guidance (Bonaccorso et al. 2015, DOFAW 2015). For Tier 5, 690 acres will be improved, and for Tier 6, 508 acres will be improved. Auwahi Wind will include a bat monitoring program to document an increase in bat activity at the site. If habitat is improved for the benefit of bats as determined through monitoring, the habitat will be considered to offset bat take.

Success Criteria

Hawaiian hoary bat activity on the parcel will be monitored to evaluate the effectiveness of the mitigation and whether the objectives of the mitigation are met. Increasing bat activity at the site as measured through acoustic monitoring will be the primary success criteria for the mitigation actions. In developing SSMIP success criteria for restoration/land-management actions, Auwahi Wind will create management actions that are specific, measurable, achievable, relevant, and time-bound. Restoration/land-management at Kamehamenui will include the following provisions as success criteria in addition to specific measurements included in the SSMIP:

- A USFWS and DOFAW-approved SSMIP is developed and implemented;
- A mitigation monitoring program is established and implemented to evaluate the progress of achieving the success criteria; and
- Acoustic (or other) monitoring for bat activity is successfully implemented at the mitigation site. The data are analyzed and reported, and the results show that the success criteria (as identified in the SSMIP) have been achieved.

Compliance Monitoring

After Tier 5 or 6 is triggered and the SSMIP is approved and implementation begins, Auwahi Wind will conduct compliance monitoring to determine the response of the Hawaiian hoary bat to the management actions implemented in the mitigation site. Auwahi Wind will conduct acoustic monitoring no less than every other year for the remaining permit term; acoustic monitoring will begin approximately 3 months after management actions have started. Acoustic monitoring will be established at nine locations for Tier 5 and six locations for Tier 6. The locations are based on a ratio of one or more detectors for approximately every 85 acres, which is 3 to 7 times greater density than similar studies (Gorresen et al. 2015, Todd et al. 2016) to provide a high level of granularity in bat use and response to management within the mitigation site. As identified in Section 6.2.4.5, the analysis is expected to use the metrics Call Abundance and Call Nightly Detection for analysis using the generalized linear mixed model framework. Insect sampling with a malaise trap will occur for one month, two times per year, in the years in which acoustic monitoring is conducted. Additionally, other monitoring will be detailed in the SSMIP to ensure that the project meets interim success goals.

Reporting

Auwahi Wind will summarize the results of the management actions implemented and monitoring in annual reports. The success criteria will be the primary metrics for analysis. Specifically, Auwahi Wind will include the following, and the SSMIP may detail additional reporting requirements:

- In the years in which the baseline acoustic monitoring is conducted, Auwahi Wind will report the results.;
- Auwahi Wind will also summarize the management actions implemented and associated results of changes that occur during the restoration process. These parameters may include:
    - Number of trees planted, acreage, and/or percent of tree cover;
    - Length of edge habitat created;
    - Number and/or surface area of water features added; and/or
    - Invasive species removed;
- A summary of acoustic monitoring data and a comparison to the baseline monitoring, including the statistical power with which any change is documented.;
- A summary of insect assessment, by season and year, and a comparison to acoustic monitoring results;
- Any adaptive management actions taken; and
- Any additional pertinent summary information needed to provide a full picture of mitigation actions.

Adaptive Management

Auwahi Wind will evaluate the best available science and latest information from peer-reviewed literature at the time Tier 5 or 6 are triggered and will define the adaptive management actions in the SSMIP. Adaptive management for restoration/management-based mitigation will ensure that mitigation activities are working as intended and offsetting the impact of the take, based on the results of monitoring:

- Interim success criteria will be developed to ensure that the long-term success criteria are met;
- If restoration/land-management efforts fail to meet the success criteria set forth in the SSMIP, corrective actions will be taken, based on the results of monitoring, such as:
  - Increase the intensity or extent of the current management actions, such as increasing the number of trees planted;
  - Increase the diversity of management actions, such as adding additional canopy or understory species;
  - Alter the management actions implemented, such as moving from reforestation to other limiting factors identified by research; and/or
  - Other actions based on the best available science and technological advances, and/or recommendations from USFWS and DOFAW, at that time.

6.2.5.2 Other Mitigation Options

Should the Kamehamenui Forest not be available for Auwahi Wind mitigation actions at the time Tier 5 or 6 are triggered, or should Auwahi Wind determine in coordination with USFWS and DOFAW that Kamehamenui Forest is no longer acceptable for mitigation, Auwahi Wind will work with the USFWS and DOFAW to identify an alternative site or other acceptable mitigation option as described below.

- *Mitigation Banking:* Mitigation banking has been identified by DOFAW as a needed addition for HCP planning. If Hawaiian hoary bat mitigation banking is established, it may provide an alternative for mitigation. Should a Hawaiian hoary bat mitigation bank(s) be established, Auwahi Wind will consult with USFWS and DOFAW on whether such a bank(s) could be used for Tier 5 and/or 6.
- *Land Protection*: Land and suitable habitat shown to support Hawaiian hoary bats may be threatened with imminent degradation, such as development or deforestation. These threats decrease the suitability of the lands to support the current population of Hawaiian hoary bats. Preservation of such lands would prevent the anticipated degradation and thereby increase the population over a potential future scenario. Should land protection be an alternative for future tiers of mitigation, Auwahi Wind will work with the USFWS and DOFAW to develop a SSMIP for the acquisition which details the plan area, the mitigation

actions, measures of success, monitoring documenting Hawaiian hoary bat use of the parcel, how the mitigation will offset take, and cost estimates.

- *Other Options:* Should other to-be-determined mitigation options be deemed more appropriate than the land-based mitigation described above for Tier 5 or Tier 6, Auwahi Wind will coordinate with the USFWS and DOFAW to identify the most appropriate mitigation measures. As identified above, the ongoing research may indicate that other mitigation measures may be more effective in offsetting bat take than the land-based option and this could include future research. Although the USFWS has indicated that research in the future Tier 5 or Tier 6 is less likely to be acceptable as mitigation, the agencies may identify that critical information is still needed. Any other mitigation option would be subject to approval by the USFWS and DOFAW.

6.2.6 Triggers for Mitigation at each Tier

In identifying the need for three additional tiers, Auwahi Wind considered:

- Refinement of the estimated Project impacts to the most precise range possible;
- Benefits of implementing phased mitigation, should take exceed a given tier, allowing for incorporation of the results from the latest research available into a mitigation plan for the subsequent tier; and
- Need for sufficient planning time to identify and implement appropriate mitigation for each potential tier of take.

Each tier of take has associated mitigation (see Section 6). To ensure that the implementation of mitigation precedes or occurs concurrently with take, the initiation of mitigation planning for the next higher tier would be triggered by reaching 75 percent of allowed take in the current tier (direct and indirect), as outlined in USFWS 2016b. provides a detailed timeline for mitigation planning and implementation under the tiered structure. Based on the prediction of take in the HCP Amendment, the annual take rate will be below 6.45 bats per year. This take rate is used to approximate a minimum estimated time between trigging a tier and the maximum take within the tier. The total take between the trigger and the tier take limit was calculated and divided by the current annual take rate. The timing between triggering planning and reaching the current tier limit is estimated to be between 1 and 2 years for Tiers 5 and 6. It is assumed that Tier 4 Mitigation will be initiated upon issuance of the requested amendment. Given one year of planning, Auwahi would have sufficient time to provide a mitigation plan for the subsequent tier, provided mitigation guidance is not altered within that timeframe.

Should triggering of subsequent tiers occur as defined in Table 6-3, Auwahi Wind will:

1. Provide notice to DOFAW and USFWS that planning for the next tier of mitigation is being initiated within 3 weeks of triggering;

2. Provide funding assurances as outlined in Section 9.4 and Appendix I within 60 days of notice that triggering has occurred;
3. Coordinate with USFWS and DOFAW to develop a specific mitigation plan for the next tier of mitigation;
4. Submit a mitigation plan to USFWS and DOFAW for the next tier of mitigation, as described in Table 6-3, within 5 months of reaching the tier trigger;
5. USFWS and DOFAW will review, revise if needed, and approve the mitigation plan within three months of receiving the final plan from Auwahi Wind. The mitigation plan will include the following information:
    I. Site-specific biological goals and objectives, including measures of success and a monitoring/evaluation program to determine the progress of meeting success criteria;
    II. Site feasibility or monitoring data if appropriate, to explain clearly why the site is suitable for bat habitat or bat survival and recovery, based on best available information;
    III. A project budget, including funding for a monitoring program and all steps necessary as identified in the plan; and
    IV. Sufficient funding assurances to cover the entire mitigation plan, including funding to respond to changed circumstances; and
6. If the mitigation plan is approved three months before the subsequent tier has been reached, Auwahi Wind may begin implementation of mitigation actions immediately, but not later than one month before the tier is reached as estimated by EoA.[16]

A description of each mitigation tier and the timing of triggering is provided in Table 6-3.

6.2.7 Funding Assurance

The cost of the Tier 4 Mitigation is outlined in Appendix I including adaptive management actions. The cost of mitigation for Tiers 5 and 6 will depend on the mitigation action selected for the tier. Based on current information, the implementation of mitigation actions in line with Tier 4 are planned for Tiers 5 and 6 should take exceed Tier 4. The total funding assurance for Tier 4 will be $4 million. Funding assurances to support the mitigation measures will be in the form of a bond,

[16] Estimation of future fatalities will use the best available information; however, the timing of future fatalities may not be known in advance. The timing of mitigation outlined here is intended to ensure that mitigation precedes take. Should take occur in the time between plan approval and implementation of the mitigation plan which increases the mortality estimate to the current tier maximum, Auwahi Wind will begin implementation of the mitigation plan immediately.

letter of credit (LOC), or similar instrument naming the USFWS and DLNR as beneficiaries. The LOC or similar financial instrument will be in place within 60 days of issuance of the ITP and ITL.

Funding assurances for Tiers 5 and 6, should they be triggered, are currently based on estimates of the cost of mitigation for Tier 4. Funding assurances for Tiers 5 and 6 have been calculated using the maximum potential acreage to be protected, the expected cost of the easement, and proportional to the take required within the tier. The cost will be adjusted for inflation using either the Federal House price index or other appropriate index, whichever more closely matches the cost of easements in the Project area at the time of triggering. Funding assurances will be put in place in accordance with the schedule for triggering outlined in Section 6.2.6. A detailed estimate of funding assurances is provided in Appendix I. Additional discussion of funding assurances can be found in Section 9.4.

6.2.8 Contingency Funds/Adaptive Management

Auwahi Wind will establish a contingency fund for the Hawaiian hoary bat for the mitigation described for Tiers 4 – 6. This fund will be 5 percent of the estimated cost of the mitigation to ensure the mitigation will be implemented. The funding of this contingency fund will be assured through the LOC described in Section 9.4.

6.3 HAWAIIAN PETREL

This section requires no edits for the HCP Amendment.

6.4 NĒNĒ

This section requires no edits for the HCP Amendment.

6.5 BLACKBURN'S SPHINX MOTH

This section requires no edits for the HCP Amendment.

7.0 MONITORING, REPORTING, AND ADAPTIVE MANAGEMENT

This section requires no edits for the HCP Amendment except as provided in the subsections below.

7.1 PROJECT-SPECIFIC TAKE

7.1.1 Monitoring Direct Take

As part of the approved HCP, a PCMP was developed and implemented to document impacts to the Covered Species as a result of operation of the Project, and to ensure compliance with the authorized provisions and take limitations of the HCP and the associated ITP/ITL (Appendix E of the approved HCP). As part of the HCP Amendment, a long-term PCMP is also provided in Appendix E. This protocol supplements the original PCMP and incorporates changes approved by and developed in consultation with USFWS and DOFAW, and the latest science with respect to wind farm post-construction mortality monitoring protocols and analysis methods.

Under the HCP Amendment and as described in the long-term PCMP (Appendix E), systematic monitoring will be conducted weekly year-round on roads and pads at operating wind turbines throughout the permit term. Searcher efficiency and carcass persistence trials will also be conducted as described in Appendix E. Post-construction mortality monitoring data will provide the information necessary to assess compliance with authorized levels of incidental take and determine if and when additional mitigation tiers are triggered.

The Wildlife Education and Incidental Reporting program is ongoing and will continue to be executed for contractors, Project staff members, and other Ranch staff who are on-site on a regular basis as outlined in the approved HCP.

The protocol for recovery, handling, and reporting of downed wildlife has been developed in cooperation with the USFWS and DOFAW. Regular Project staff will be trained in this protocol during the wildlife education briefings and will be responsible for documenting observed fatalities or injury to wildlife. The USFWS and DOFAW will be notified promptly upon discovery of an injured or dead state- or federal-listed species. The current Downed Wildlife Protocol is included in the Project PCMP (USFWS and DOFAW 2017; Attachment 1 of Appendix E). This protocol includes:

- Procedures to follow upon the discovery of a downed seabird or bat including a prioritized contact list of DOFAW and USFWS staff; and
- Guidelines for handling, if permitted, injured wildlife or carcasses.

Federal- or state-listed species found injured or dead will be treated as directed in the Downed Wildlife Protocol guidance provided by USFWS and DOFAW. Non-listed species may be collected by staff members included on the USFWS Special Purpose Permit and the DOFAW Protected Wildlife Permit issued for the Project, which grant permission and include provisions for handling native wildlife.

7.1.2 Estimating Indirect Take

As described in Section 5.1.2, take of a female bat during the breeding season may result in the indirect loss of dependent offspring. Females are solely responsible for the care and feeding of young. Therefore, indirect take is only associated with the death of an adult female bat in the breeding season. Indirect take estimation methodology and the variables used to quantify indirect take associated with the total Project direct take are listed in Appendix E and are based on Auwahi Wind data and current agency guidance (USFWS 2016a).

7.2 Non-Fatality Monitoring

7.2.1 Hawaiian Hoary Bats

Non-fatality acoustic and thermal imagery monitoring will be conducted the Project site and the mitigation site as described in Section 7.4.1.2

7.2.2 Hawaiian Petrels

This section requires no edits for the HCP Amendment.

7.3 Reporting

Auwahi Wind will prepare and submit semi-annual and annual reports consistent with the description in the approved HCP with the following clarifications:

- The Project will provide annual and semi-annual updates on the 80 percent upper credible limit of take to identify tier triggers and assess compliance with tier limits and the authorized take limit;
- Annual reports will include updated post-construction mortality monitoring detection probability correction results through June 30 of the report year;
- Annual reports will detail the progress of meeting mitigation success criteria, for all tiers;
- Annual reports will describe any adaptive management measures implemented, the timeline for their implementation, and how the measures will improve the ability to meet minimization or mitigation objectives; and
- Annual reports will include the update of funding and funding assurances.

An annual presentation on status and results of any mitigation-funded research projects will be made to the ESRC or subcommittee during the research project's period of performance, and a final research report and associated data for any mitigation-funded research projects will be prepared as described in Section 6.

7.4 Adaptive Management

The U.S. Department of the Interior defines adaptive management as a structured approach to decision-making in the face of uncertainty that makes use of the experience of management and the results of research in an embedded feedback loop of monitoring, evaluation, and adjustments in management strategies (Williams et al. 2009). Uncertainties may include the lack of knowledge regarding biological information for the Covered Species; the effectiveness of minimization, mitigation, or management techniques; or the anticipated effects of the Project. Adaptive management is a required component of HCPs that allows for flexibility over time during the implementation of the HCP as new information becomes available. Adaptive management requires explicit and measurable objectives, and identifies what actions are to be taken and when.

7.4.1 Adaptive Management of Minimization Measures

Auwahi Wind developed an adaptive management strategy to evaluate not only initial minimization measures currently being implemented but to also provide for potential future adjustments to minimization measures as new information or technology becomes available over the Project permit term. The Auwahi Wind adaptive management strategy described in this section includes the following elements:

1. Initial minimization measures (Section 7.4.1.1);
2. Monitoring of the fatality rate (Section 7.4.1.2) to determine the effectiveness of implemented initial minimization measures, and whether changes to such measures are needed;
3. A risk analysis (Section 7.4.1.3) to determine the factors that correlate with periods of risk for bats;
4. An Adaptive Management Plan (AMP; Appendix K) that identifies specific measures to reduce the risk to bats using the risk analysis results and the best available information (Section 7.4.1.4);
5. A schedule for evaluating minimization effectiveness, and quantitative triggers for implementing adaptive management measures (Section 7.4.1.5); and
6. A means of incorporating new information and technology into the AMP (Section 7.4.1.6).

The key terms used in developing and implementing the AMP are defined below:

- **Threshold Value** – The Threshold Value is calculated as the total requested direct take (129 bats) divided by the expected operational life of the Project (20 years). For Auwahi Wind, the Threshold Value is 6.45 direct take per year (129 direct take estimated by EoA / 20 years of operation). The Threshold Value for this Amendment is based on a projected 30% reduction in take rate from current levels (2012-2018) for the remaining life of the Project (2019-2032) and represents a take rate that would result in a take estimate equal to the Tier 6 maximum take at the end of the permit term.
- **Baseline Fatality Rate** – Auwahi Wind will use the EoA model (Dalthrop et al. 2017) to analyze both current and prior years of PCMM data to calculate the current average annual

direct fatality rate, referred to as the Baseline Fatality Rate. This fatality rate considers all prior years of PCMM data (relative to a rho value of 1). The result is a direct fatality rate from the start of monitoring to the most recent data at the 80 percent credible level. (Examples of the outputs of EoA including the Baseline Fatality Rate are provided in Appendix H and can be found in the Auwahi Wind Annual report for FY 2017.) Adaptive management, as detailed in the AMP, will be required if the Baseline Fatality Rate exceeds the Threshold Value.

- **Curtailment Night -** Auwahi Wind is using the concept of "curtailment nights" to optimize the implementation of LWSC to reduce risk to bats. A curtailment night is the equivalent of one turbine curtailed to the highest LWSC cut-in speed (6.9 m/s) for one night (30 minutes before sunset to 30 minutes after sunrise). The Initial Minimization Measures include 728 continuous curtailment nights per year (8 turbines curtailed to 6.9 m/s from August through October). The application of adaptive management to curtailment nights allows for specificity in curtailment implementation, while maintaining flexibility to implement the curtailment in the highest risk periods. Examples of applying curtailment nights could include:
  - Two turbines curtailed for half of the night equals 1 curtailment night.
  - One turbine curtailed for the entire night, with a cut-in speed of 6.9 year-round, equals 365 curtailment nights.

7.4.1.1 Initial Minimization Measures

In response to the higher than anticipated take of bats, Auwahi Wind previously began implementing voluntary adaptive management measures to reduce the risk of bat take as described in Section 4.2.7. Auwahi Wind also voluntarily incorporated canine searching into the downed wildlife monitoring protocol (January 2018) to increase the probability of detection of downed wildlife. As described in Section 4.2.7, these voluntary measures, referred to here as the "initial minimization measures," include:

1. Implement LWSC of 5.0 m/s for all eight turbines from 30 minutes before sunset to 30 minutes after sunrise for the months of November through July.
2. Implement LWSC of 6.9 m/s for all eight turbines from 30 minutes before sunset to 30 minutes after sunrise for the months of August through October.

7.4.1.2 Monitoring

Monitoring is an essential element of the minimization measures and informs the adaptive management strategy. The Post-Construction Mortality Monitoring (PCMM) protocol is outlined in the monitoring plan (Section 7.1.1, Appendix E). The purpose of this monitoring is to evaluate the efficacy of the minimization measures and determine if there is a need to implement adaptive management actions to ensure minimization goals and objectives are met.

7.4.1.3 Risk Analysis

As summarized in Section 3.8.1.3, the current understanding of bat behavior at turbines and associated environmental conditions is limited. Based on the current best available information, factors thought to correlate with bat risk include temperature, barometric pressure, moon phase, insect abundance, time of night, geographic features, and other site-specific parameters.

Auwahi Wind is conducting nacelle acoustic monitoring and ground based thermal imagery studies in 2018 -2019 to determine bat exposure rates and identify factors correlated with risk to bats at the Project. These studies will look at general trends in timing of bat observations, patterns of behavior, and other factors that may allow Auwahi Wind to optimize minimization measures or turbine operations that could further reduce the risk to bats. The studies are described below:

1) Four turbine nacelles were instrumented with acoustic monitoring devices. The monitoring is to be conducted for 12 months (July 2018 – June 2019). Simultaneously, meteorological data will be collected at these turbine nacelles.
2) A thermal video system was installed with support from USGS. This system collected data in combination with the acoustic monitoring devices for 3 months (August – October 2018).
3) Data will be analyzed in between November and December, 2019 to investigate: 1) the proportion of acoustic detections also observed with the thermal video system to assess whether acoustic activity is a good proxy for exposure; 2) the behaviors bats are exhibiting while interacting with the turbines; 3) the range and upper thresholds of wind speeds at which bats are observed; and 4) if other environmental factors or behaviors correlate with risk in such a manner that they can be used to mitigate risk.

Auwahi Wind will analyze the results of these studies, as well as other research being conducted by others specific to Hawaiian hoary bats, in the 4th quarter of 2019, to identify the time periods and conditions which present the greatest risk to bats, and use that to revise the Interim AMP (Appendix K).

7.4.1.4 Adaptive Management Plan

Auwahi Wind has developed an interim AMP to describe the schedule and actions based on the knowledge available at the time the HCP Amendment was developed. As noted in Section 7.4.1.3, currently it is not fully understood how environmental conditions and bat behavior may influence risk to bats from turbines. Therefore, Auwahi Wind will use the research results and risk analysis discussed above, and use that best available, Project-specific information to update the Interim AMP (Appendix K) into the working AMP in late 2020 (hereafter referred to as the AMP). The AMP specifies adaptive management measures to further minimize risk to bats. Such measures would then be implemented if adaptive management is required as described below in Section 7.4.1.5.

The AMP includes a schedule for evaluating the Baseline Fatality Rate and associated triggers for implementation of adaptive management. Thus, the AMP includes:

1. Ongoing review of developments in minimization measures;
2. The specific minimization measures planned for application to further reduce the risk to bats if adaptive management is triggered;
3. The schedule for evaluation of the Baseline Fatality Rate (Section 7.4.1.5); and
4. The triggers for implementation of adaptive management (Section 7.4.1.5).

When coordinating with USFWS and DOFAW, the timing of developing the AMP and implementing adaptive management measures will consider the following:

- After the 2019 third quarter risk analysis (Section 7.4.1.3), the AMP will be revised (from the interim AMP) and describe specific minimization measures to be implemented at the Project through adaptive management. The AMP will be provided to the USFWS and DOFAW for review and approval by April 30, 2020 prior to the evaluation of the Baseline Fatality Rate in 2020.
- If evaluation of the Baseline Fatality Rate indicates that adaptive management is required but Auwahi Wind has not received approval of the AMP by USFWS and DOFAW, Auwahi Wind will implement the adaptive management measures identified in the AMP as an interim measure pending agency approval of the AMP.
- If subsequent data warrant any change to the AMP previously submitted to USFWS and DOFAW, Auwahi Wind will submit a revised AMP to USFWS and DOFAW for approval. The revised AMP may be implemented as an interim measure, pending approval by USFWS and DOFAW.

Adaptive Management Responses

The AMP identifies specific responses to further reduce bat risk, which will be implemented if triggered by the results of the Baseline Fatality Rate assessments discussed in Section 7.4.1.2. These responses include modifications to the LWSC program or other actions, based on the best available science. Project post-construction mortality monitoring data and results from bat activity monitoring will be used to determine the most appropriate responses. Factors considered in the adaptive management response analysis include:

- The spatial distribution of fatalities at the wind farm;
- The timing of fatalities in terms of season and/or months of the year;
- The available data provided from bat activity monitoring (2018-19 thermal and acoustic studies) including nightly bat activity peaks, bat behaviors, correlation of activity to environmental conditions, etc.;
- The availability of new technologies that may further reduce risk to bats; and
- Other newly available literature or data.

The AMP prioritizes temporal and spatial adjustments of the initial curtailment nights if the Baseline Fatality Rate exceeds the Threshold Value. For any redistribution of curtailment nights, the curtailment night will be applied to the highest period of risk (or other correlate of risk). Regardless of adjustment in curtailment nights, no cut-in speed will be lower than 5 m/s.

Future studies may indicate patterns of risk that then inform whether and how curtailment nights should be redistributed. The AMP describes how Auwahi Wind will adjust curtailment nights from periods of lower risk to higher risk, if warranted. Should redistribution of curtailment nights not provide the necessary take rate reduction, additional adaptive management measures will be implemented and are described in the AMP. Auwahi Wind may also implement additional voluntary minimization measures beyond those outlined in this section.

7.4.1.5 Schedule and Triggers

This adaptive management strategy will ensure the Project remains in compliance with its ITP/ITL take limit. Auwahi Wind coordinates annually with USFWS and DOFAW and provides annual and semi-annual reports on the HCP as described in Section 7.3. Additionally, Auwahi Wind provides USFWS and DOFAW updated take estimates after each fatality observed in Post-construction monitoring. This schedule of take estimation, and calculation of the Baseline Fatality Rate, allows the project to track closely the Baseline Fatality Rate between scheduled evaluations.

The timing of the scheduled evaluations will provide sufficient data to evaluate the effect of the minimization measures. The Baseline Fatality Rate is key to determining if adaptive management is necessary and will be the basis for implementing the AMP. Auwahi Wind will calculate the Baseline Fatality Rate, and then compare that to the Threshold Value, at scheduled evaluations in 2020, 2025, and 2030, to determine if adaptive management actions are required. Comparing the Baseline Fatality Rate to the Threshold Value will allow Auwahi Wind, USFWS, and DOFAW to ensure the Project is on track to remain below the permitted take.

For the years in which the Baseline Fatality Rate will be compared to the Threshold Value (i.e., 2020, 2025, 2030) to determine if adaptive management actions are required, the evaluation will be completed in February and will be based on data from January 2013 through December 31 of the preceding year. If adaptive management measures are required, they will be implemented as soon as possible, but no later than March 31.

Possible future scenarios are:

- Should the Baseline Fatality Rate exceed the Threshold Value at a given scheduled evaluation, the actions identified in the AMP will be implemented. In this scenario, evaluation of the fatality rate will occur again 2 years following the implementation of additional measures to assess effectiveness.
- Should the Baseline Fatality Rate be equal to or fall below the Threshold Value, no adaptive management action will be required.

Any change to minimization measures will be assessed for its effect on the Baseline Fatality Rate after two years using post-construction mortality monitoring data. At that time, the Baseline Fatality Rate will be compared to the Threshold Value to determine if further adaptive management is triggered. Should the Baseline Fatality Rate exceed the Threshold Value at that time, further adaptive management actions will be taken per the AMP, and the Baseline Fatality Rate will be re-evaluated again at 2-year intervals until the Baseline Fatality Rate is equal to or less than the Threshold Value. Should an adaptive management adjustment be triggered less than 2 years from a scheduled evaluation year (2020, 2025, 2030), the next evaluation will occur 2 years after the adjustment instead of at the scheduled evaluation. Auwahi Wind has adopted this assessment approach given that observed fatalities are relatively rare events; and therefore, data from a single year of implementation may lack sufficient statistical power to detect an effect.

In summary, the AMP provides for multiple check-ins (minimum annual basis) on the fatality rate and opportunities to implement additional adaptive management measures. The scheduled evaluations provide a hard trigger for a mandatory full assessment. For example:

1. If the Project is predicted to exceed the permit authorization at the evaluation in 2020, adaptive management actions must be implemented to reduce the fatality rate. Following the implementation of adaptive management actions, the fatality rate will be evaluated again in 2022 to determine if additional adaptive management actions are required. This process will be repeated every two years until the Project is no longer predicted to exceed the permitted take authorization.
2. Alternatively, if the projection suggests the Project will remain within the permitted take authorization at the 2020 scheduled evaluation, no adaptive management action will be required. The next evaluation to determine if adaptive management actions are required will be in 2025.

Should a projection at any routine evaluation predict that the Project will exceed the permitted take authorization between scheduled evaluations, Auwahi Wind, in coordination with USFWS and DOFAW, will determine if adaptive management actions are warranted. Additionally, the AMP will be reviewed annually, and updated if appropriate, to incorporate and prioritize the best available minimization measures.

7.4.1.6 Future Technologies/Research

Numerous studies related to bat activity around wind turbines are being conducted in North America and Europe to understand the risk to bats. These studies include looking at influences of weather, wind speeds, LWSC, etc. on bat fatalities in addition to developing avoidance technologies such as deterrents. Results of some studies show promise, while others may introduce new questions for future study. For example, BCI looked at the impact of 20-minute averaging to control the implementation of LWSC, but found no statistically significant difference in the number of observed fatalities between control and treatment (Schirmacher et. al 2018). Additionally, BCI looked at the use of met tower data to control the implementation of LWSC; however, the met tower measured a lower wind speed than turbine wind speeds, which effectively resulted in an increase of the cut-in speed by 1 m/s, reducing the minimization effect. As these efforts to find effective alternative minimization measures for bats continues, Auwahi Wind will actively monitor the availability of new information that may inform its AMP, and potentially incorporate new minimization measures that may be more effective and feasible than those outlined in this HCP Amendment.

This HCP Amendment anticipates that an effective, economical, and commercially-viable Hawaiian hoary bat deterrent will ultimately be developed. However, such technology is still in the testing phase, and although it shows promise for reducing bat take (Weaver et. al 2018), there are no commercially available systems at this time proven to be effective in Hawaii. However, preliminary research indicates that technologies may be developed during the Project permit term that could deter the Hawaiian hoary bat from flying into the airspace near the wind turbine blades (Szewczak and Arnett 2007, Arnett et al. 2013, Hein and Schirmacher 2013). In 2017 and 2018, studies from mainland wind farm sites showed that deterrents could reduce mainland hoary bat fatalities between 20 percent and 100 percent. (Morton 2017, Weaver et. al 2018). Thus, there is still uncertainty as to the effectiveness of deterrents that are available to be tested. Additionally, in 2018 a deterrent test was initiated in Hawai'i at an operating wind farm where LWSC is also being implemented. Preliminary results of this Hawai'i research are expected to be available in May 2019, and peer-reviewed publications on results of deterrent effectiveness for mainland studies are anticipated in 2020 or later. Should LWSC adaptive management strategies not be effective in minimizing impacts to bats, deterrents or similar technologies will be a priority. Should a redistribution of curtailment nights not provide sufficient minimization to keep the Project within the total take authorization, Auwahi Wind will implement an acoustic deterrent system or an alternative minimization technology (provided they are commercially available, demonstrated to be effective in Hawai'i, and determined not to negatively impact other wildlife). Deterrent technology is incorporated in the adaptive management measures described in the AMP with the proposed measures provided to USFWS and DOFAW for review and approval.

7.4.2 Adaptive Management of Mitigation

7.4.2.1 Tier 4 Mitigation

Adaptive management actions for Tier 4 are specified in Section 6.2.4

7.4.2.2 Tier 5 and Tier 6 Mitigation

Adaptive management actions for Tiers 5 and 6 are specified in Section 6.2.5

8.0 ALTERNATIVES

8.1 FULL NIGHTTIME SHUTDOWN

This alternative would consist of ceasing nighttime operations by feathering turbine blades year-round from one hour before sunset to one hour after sunrise at all Project turbines to avoid additional Hawaiian hoary bat take. While this alternative would prevent future take, because the 80 percent upper credible limit of take exceeds the level authorized in the approved HCP, this alternative would still require an HCP Amendment. The approved HCP, which identifies existing avoidance and minimization measures, authorized take, mitigation measures, and monitoring commitments for Covered Species, would be modified to include take authorization up to the current 80 percent upper credible limit value. This alternative was not selected for consideration because ceasing operations at night year-round would trigger a clause in the PPA that would modify Auwahi Wind's priority for providing power to Maui Electric Company (MECO). This action is irreversible and will result in the Project being heavily curtailed for the remainder of the PPA term, to the point where the Project could no longer operate due to the financial impact.

8.2 YEAR-ROUND CURTAILMENT AT 6.9 M/S

This alternative would consist of curtailing at 6.9 m/s year-round. The evaluation of risk to bats also includes the potential benefit to bats of the added months of curtailment. Pertinent data on the months in which risk is low were evaluated. From the start of operation through December 2017, no fatalities were observed in the months of February through May, and December. One fatality was found in each of the months January, June, July, and November. Auwahi Wind did not select this minimization alternative because it did not correspond with the seasonal differences in risk to Hawaiian hoary bat identified in five years of Project-specific monitoring. Adding curtailment nights to periods where bats are not present or where the risk is not significant will not have an appreciable benefit to the Hawaiian hoary bat but would significantly impair the ability of the Project to meet its energy output obligations, operate in an economically reasonable manner, and would lessen generation of nighttime clean energy on Maui which is principally derived from wind energy. For all of the above reasons, this alternative was not selected for implementation.

8.3 FULL NIGHTTIME SHUTDOWN FROM AUGUST TO OCTOBER

This alternative would consist of shutting down the Project at night from August through October. The benefit of LWSC with cut-in speeds of 6.9 m/s proposed in the HCP Amendment (Section 4.2) is estimated to reduce bat fatalities by 76 percent. For cut-in speeds above 6.9 m/s insignificant gains in take reduction are predicted. Additionally, as cut-in speeds are increased, the amount of potential power loss increases exponentially up to 10 m/s. Figure 8-1 shows a representative power curve for a Siemens SWT-3.0 where power generation typically increases significantly beyond 5.0 m/s. Adding curtailment to period of higher wind speeds when bat risk is minimal would not be expected to have a significant benefit to bats but would significantly impair the ability of the Project to meet its energy output obligations and operate in an economically reasonable manner. Maui Additionally, nighttime clean energy generation on Maui is principally derived from wind energy, which would be impaired in this alternative. Given that risk to bats is significantly reduced at greater wind speeds and the power losses are exponential, full nighttime shutdown at Auwahi Wind for the months of August to October was not selected for implementation.

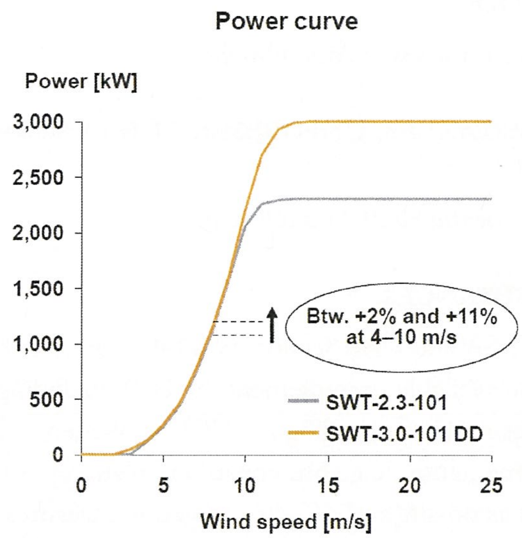


Figure 8-1. Power Curve for a Siemens SWT-2.3 and SWT-3.0 (NREL 2010)

8.4 REDUCED PERMIT TERM

This alternative would consist of amending the Auwahi Wind HCP to increase authorized bat take for a reduced permit term of ten years and assumes the development and deployment of a 100 percent effective, economical, and commercially-viable bat deterrent by 2022 (which would prevent any additional incidental take and thus preclude the need for additional years of take authorization). After nearly five years of Project operation, the 80 percent upper credible limit of Hawaiian hoary bat take exceeds the authorized take limit. Therefore, even with the implementation of avoidance and minimization measures such as LWSC, Auwahi Wind would need to amend the HCP to increase authorized bat take (Auwahi Wind 2017). Reducing the permit term has the potential to create a legal liability or the need for a future Major Amendment for Auwahi Wind associated with non-compliance with the ESA and Chapter 195D should such a deterrent system not become available and incidental take at the Project exceed take authorized in the ITP/ITL. Although initial research from North America has suggested bat deterrent technology may be an effective minimization measure for reducing take of migratory tree-roosting bats (Szewczak and Arnett 2007, Arnett et al. 2013, Hein and Schirmacher 2013, Weaver et al. 2018), it is highly uncertain whether or not future advancements in the technology will be sufficient to ensure take of the resident Hawaiian hoary bat can be avoided completely by 2022. For these reasons, this alternative was not selected for implementation.

9.0 PLAN IMPLEMENTATION

9.1 RESPONSIBILITIES

This section requires no edits for the HCP Amendment.

9.2 SCOPE AND DURATION

This section requires no edits for the HCP Amendment.

9.3 CHANGED CIRCUMSTANCES, UNFORESEEN CIRCUMSTANCES, AND NO SURPRISES POLICY

This section requires no edits for the HCP Amendment.

9.4 FUNDING AND ASSURANCES

Section 10(a)(2)(B)(iii) of the ESA and HRS Section 195D-4(g) require that HCPs ensure that adequate funding will be made available to implement the HCP including the proposed monitoring and mitigation plans. Measures requiring funding for HCP implementation typically include activities associated with Project implementation (e.g., pre-construction surveys or post-construction mortality monitoring), as well as on-site and off-site mitigation measures (e.g., acquisition of mitigation lands, restoration, or contributions to research), measures to respond to foreseeable Changed Circumstances, and funding for DLNR HCP technical assistance and compliance monitoring. Section 195D-4(g) also requires the applicant to "post a bond, provide an irrevocable letter of credit, insurance, or surety bond, or provide other similar financial tools, including depositing a sum of money in the endangered species trust fund created by Section 195D-31, or provide other means approved by the board, 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 take."

Auwahi Wind will post a LOC with a banking institution subject to regulation by the United States or other acceptable financial assurance measure for up to $4,013,047 to cover the costs of implementing all of its obligations for the HCP Amendment and Tier 4 bat mitigation (including DLNR technical assistance and compliance budgets, see Appendix I for the funding matrix). The total value of this LOC (or other acceptable financial assurance) may be adjusted periodically over time to account for financial obligations that have been fulfilled. This LOC (or other acceptable financial assurance) will be provided within 60 days of issuance by USFWS of the amended ITP, issuance by DLNR of the ITL, and execution of any needed amendment to the Implementation Agreement. The take authorization contained in the amended ITP/ITL is not effective until Auwahi Wind provides to the USFWS and DLNR executed copies of the LOC (or other acceptable financial assurance) containing terms acceptable to the USFWS and DLNR. If a subsequent tier of mitigation is triggered, financial assurances for that tier (not met through the existing financial assurances, accounting for yet unfulfilled HCP financial obligations) will be provided to ensure funding for mitigation obligations under that tier. A commitment to make such future funding assurances will be included in the revised Implementing Agreement for the Amendment.

Funding assurances for Tiers 5 and 6, should they be triggered, are currently based on costs anticipated for expanding the mitigation outlined in Tier 4 to additional lands. Funding assurances for Tiers 5 and 6 will be calculated as was Tier 4 using the maximum potential acreage to be protected, the expected cost of the mitigation, and proportional to the take required within the tier. The cost will be adjusted for inflation using an appropriate index, which closely matches the cost of mitigation actions in the Project area at the time of triggering. Funding assurances will be put in place in accordance with the schedule for triggering outlined in Section 6.2.6. A detailed estimate of funding assurances is provided in Appendix I.

The funding assurance amounts for Tiers 5 and 6 would be approximately $2,274,059 and $1,672,102, respectively, using Tier 4 costs as a basis and adjusted accordingly to the mitigation to be implemented at the time the tier is triggered. If planning for the next higher tier is triggered, any required additional funding assurances for tiers above Tier 4 will be provided no later than 60 days of notifying USFWS and DOFAW of triggering. An estimate of the costs for implementing the additional mitigation under the HCP Amendment is provided in Appendix I. These estimates and the funding assurance will be adjusted once a mitigation plan is approved by USFWS and DOFAW.

Post-construction mortality monitoring costs are estimated at $100,000 per year and are included in the Project operations costs. No financial assurance is required for monitoring costs because take authorization is contingent upon compliance with this HCP, and monitoring must occur simultaneous with Project operations. DLNR compliance costs are estimated at $10,000 annually and will be paid out of Project funds each year.

The LOC will be issued by a financial institution organized or authorized to do business in the United States and identify the DLNR as the sole payee with the full authority to demand immediate payment in the case of default in the performance of the terms of the permit and HCP. The LOC presented for approval will contain the following provisions:

- The LOC will be payable to the State of Hawaiʻi DLNR;
- The expiration date will not be less than one year from the effective date of the LOC and will contain a provision for automatic renewal for periods of not less than one year unless the bank provides written notice of its election not to renew to the DLNR at least 90 days prior to the originally stated or extended expiration date of the LOC;
- The LOC will contain provisions allowing collection of the remainder of the costs by the DLNR for failure of the permittee to replace the LOC when a 90-day notice is given by the bank that the LOC will not be renewed and the LOC is not replaced by another LOC approved by the USFWS and DLNR at least 30 days before its expiration date; and

- The LOC will be payable to the DLNR upon demand, in part or in full, upon notice stating the basis thereof, which possible bases will be identified in the Implementing Agreement (e.g., default in compliance with the permit or HCP or the failure to have a replacement for an expiring LOC).
- The LOC will include security for 1) mitigation obligations, and 2) sufficient contingency funds to cover inflation and changed circumstances, as reflected in the funding matrix (see Appendix I). The LOC will be renewed annually based on the outstanding mitigation cost at the start of the following year. The purpose of the LOC will be to secure the necessary funds to cover costs in the unlikely event that the applicant does not fulfill its obligations under the ITP/ITL and HCP Amendment.

9.5 ADAPTIVE MANAGEMENT

[Moved to Chapter 7.4]

9.6 REVISIONS AND AMENDMENTS

This section requires no edits for the HCP Amendment.

9.6.1 Minor Amendments to the HCP

This section requires no edits for the HCP Amendment.

9.6.2 Major Amendments to the HCP

This section requires no edits for the HCP Amendment.

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APPENDIX A

BOTANICAL, AVIAN AND TERRESTRIAL MAMMALIAN SURVEYS CONDUCTED FOR THE AUWAHI WIND FARM PROJECT, ULUPALAKUA RANCH, ISLAND OF MAUI

This Appendix requires no edits for the HCP Amendment

APPENDIX B

AUWAHI WIND PROJECT REVEGETATION POTENTIAL PLANT LIST

This Appendix requires no edits for the HCP Amendment

APPENDIX C

AUWAHI WIND FARM FIRE MANAGEMENT PLAN

This Appendix requires no edits for the HCP Amendment

APPENDIX D

AUWAHI WIND CULTURAL RESOURCES AVOIDANCE, MINIMIZATION, AND MITIGATION

This Appendix requires no edits for the HCP Amendment

APPENDIX E

AUWAHI WIND FARM PROJECT POST-CONSTRUCTION MONITORING PLAN

Revised for the HCP Amendment

AUWAHI WIND FARM PROJECT
POST-CONSTRUCTION MONITORING PLAN

Prepared for

Auwahi Wind Energy, LLC

Prepared by

TETRA TECH

Original: December 2011

Revised for Amendment: May 2019

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ATTACHMENTS

ABBREVIATIONS AND ACRONYMS

agl	above ground level
Auwahi Wind	Auwahi Wind Energy LLC
DLNR	Hawai'i Department of Land and Natural Resources
DOFAW	Hawai'i Department of Land and Natural Resources/Division of Forestry and Wildlife
ESA	Endangered Species Act
GPS	global positioning system
HCP	Habitat Conservation Plan
HNP	Haleakala National Park
ITL	Incidental Take License
ITP	Incidental Take Permit
KWP	Kaheawa Wind Power
PCMP	Post-Construction Monitoring Plan
Plan	post-construction mortality monitoring plan
Project	Auwahi Wind Farm Project
TBD	To be determined
USFWS	U.S. Fish and Wildlife Service
WTG	wind turbine generator

ORIGINAL HCP POST CONSTRUCTION MONITORING PLAN

The original Auwahi Wind HCP included a Post-Construction Monitoring Plan (PCMP; Appendix E) that is provided below in Sections 1 through 8. This original PCMP included an initial period of intensive monitoring. Based on the results of the intensive monitoring and with agency approval, the monitoring protocols and search area were adaptively modified as provided for in the PCMP. The Long-term Monitoring Plan prepared for this HCP amendment was developed based on the results of the intensive monitoring period, the best available science, and the other adaptations to improve safety and efficiencies. The Long-term Monitoring Plan that guides the monitoring moving forward associated with this amendment is described in Section 9 through 14 as a supplement to the original PCMP. Auwahi Wind did not revise the original HCP PCMP because it is the plan that guides the Project the HCP amendment is granted.

1.0 INTRODUCTION

1.1 PROJECT BACKGROUND AND PURPOSE OF THE POST-CONSTRUCTION MONITORING PLAN

Species listed under the federal Endangered Species Act (ESA) of 1973, as amended, and the State of Hawaii endangered species statutes, have the potential to occur in the vicinity of the Auwahi Wind Farm Project (Project), including the Hawaiian petrel, nēnē, and Hawaiian hoary bat. Individuals of these species could be killed or injured if they collide with wind turbine generators (WTG), or when bats fly close enough to experience barotrauma. In bats, barotrauma is tissue damage to the lungs caused by rupture of small blood vessels that results from the rapid air-pressure reduction near moving WTG blades (Baerwald et al. 2008).

Due to the potential for incidental take of these species, Auwahi Wind Energy LLC (Auwahi Wind) has consulted with the U.S. Fish and Wildlife Service (USFWS) and the Hawaii Department of Land and Natural Resources (DLNR) to acquire an Incidental Take Permit (ITP) and an Incidental Take License (ITL) issued by these agencies, respectively. These permits issued in accordance with Section 10(a) (1) (B) of the ESA and Section 195 D of the Hawaii Revised Statues, respectively, require the preparation of a Habitat Conservation Plan (HCP).

This Post-Construction Monitoring Plan (PCMP) has been developed as a means to document impacts, or lack thereof, to the Covered Species as a result of operation of the Project, and to ensure compliance with the authorized provisions and take limitations of the HCP and the associated ITP/ITL. Based on the results of post-construction monitoring, avoidance and minimization measures as outlined in the HCP adaptive management strategy could be modified, or additional measures identified and implemented, as necessary, should Project effects differ substantially from what was anticipated.

Although the PCMP is implemented to document any potential incidental take of threatened or endangered species, impacts to non-listed species will be recorded for informational purposes. Additionally, although survey efforts will focus on documenting mortality through standardized searches, all injuries and mortality associated with the project (e.g., vehicle strikes) will be documented.

1.2 COMPONENTS OF THE PCMP

Wind farm-related fatality estimation is based on the number of carcasses found during carcass searches conducted under operating WTGs. Both the length of time carcasses remain on site before being removed by scavengers (carcass removal rate) and the ability of searchers to locate carcasses (searcher efficiency) can bias the number of carcasses located during standardized searches. Therefore, this PCMP includes 1) methods for conducting standardized carcass searches to monitor potential injuries or fatalities associated with Project operation, 2) carcass removal trials to assess seasonal, site-specific carcass removal rates by scavengers or other means, and 3) searcher efficiency trials to assess observer efficiency in finding carcasses. Vegetation conditions also will be assessed and documented as part of the monitoring protocol when conducting carcass searches and carcass removal and searcher efficiency trials. The proposed field and analytical methods are consistent with post-construction monitoring being conducted, or proposed, for other wind projects in Hawaii and other U.S. locations (Johnson et al. 2000; Kerns and Kerlinger 2004; Fiedler et al. 2007; NWC and West 2007; Tetra Tech 2008; KWP 2006, 2011; Erickson 2009; Arnett et al. 2009a; SWCA 2010; Poulton and Erikson 2010; Strickland et al. 2011), but have been adapted to the specific characteristics of the Project.

The PCMP protocol outlines the surveys and trials to be conducted and provides an adaptive management approach to post-construction monitoring. Methods and timing outlined in this protocol may be modified over time as project-specific information is obtained to maximize the effectiveness and efficiency of the monitoring program (e.g., search interval, the number of WTGs searched, plot size). Additionally, recent advancements in the science of post-construction monitoring have resulted in variations in the standard monitoring protocol based on site-specific conditions at individual wind farms, species of interest, study objectives, and statistical developments in the quantification of bias correction factors and mortality rates (Shoenfeld 2004; Jain et al. 2007, Arnett et al. 2009a; Huso 2010). It can be assumed that post-construction monitoring techniques will continue to be refined over the 25-year life of the ITP and ITL. Therefore, the intent of this protocol is to provide a sound framework that can apply the best available science over the long term. Any recommended changes to the protocol from the baseline provided herein would require review and approval by USFWS and DLNR/Division of Forestry and Wildlife (DOFAW).

1.3 OTHER NECESSARY PERMITS

Prior to initiating surveys, permits required to implement the monitoring program will be obtained, including the USFWS Special Purpose Permit and the DOFAW Protected Wildlife Permit. These permits grant permission and include provisions for handling wildlife and carcasses. They will be required for handling any native wildlife carcasses used in the searcher efficiency and carcass removal trials described below, unless other legal species, such as chickens are used.

2.0 STANDARDIZED CARCASS SEARCHES

The objective of the standardized carcass searches is to systematically search WTG locations for avian and bat casualties that are attributable to collision with Project facilities or barotrauma. Although all fatalities will be recorded, the PCMP focuses on listed species. For purposes of this PCMP, the casualties will be referred to as collision-related fatalities.

2.1 SAMPLING DURATION AND INTENSITY

The PCMP carcass searches to document avian and bat fatalities will begin once all WTGs are constructed and commissioning activities are complete.

Year 1 – Avian species: During the first year of operation, post-construction monitoring for potential avian fatalities focusing on seabirds will consist of systematic searches beneath each of the Project's 8 WTG (Table 2-1). Weekly searches will be conducted from March through June. Surveys will be conducted twice per week from July through November that includes the petrel fledgling period (October to the end of November). This timeframe will encompass movements of the Hawaiian petrel between nesting areas in Haleakala National Park (HNP) and the ocean during pre-nesting, nesting, and fledging (March through November; Simons and Hodges 1998). Monthly surveys will be conducted from December through late February when seabirds are not present on Maui..

Year 1 – Bats: Unless otherwise dictated by the results of carcass removal trials (Section 3.0), bi-weekly (two times per week) searches for potential bat fatalities will be conducted during the potential high activity period of Hawaiian hoary bats (Table 2-1). Hawaiian hoary bats are thought to breed in Hawai'i during April through August, although this has not been verified on Maui. The peak bat activity period at KWP 1 and 2 and the Auwahi Projects is July – November so those periods would have the highest potential for bats to be present in the Project area (Menard 2001, SWCA 2011, Auwahi unpublished data). Therefore, more intensive monitoring is proposed for this period. The purpose of the bi-weekly search interval for bats is to minimize the influence of searcher efficiency. The average carcass persistence time at KWP I is approximately 7 days; therefore, bi-weekly searches should give searchers two opportunities to detect a given carcass. The effect of this approach can be a significant improvement in search efficiency. For example, if searcher efficiency is 60 percent, the probability of missing the same carcass twice is only 14 percent (0.40 * 0.40).

Year 2 – During Year 2 of the PCMP, search frequency from January to March and from October to December will remain unchanged (Table 2-1) unless dictated otherwise by the results of Year 1 bias trials. The frequency of searches during the bat activity period (July-September) will be based on the results of bias trials conducted in Year 1, in coordination with and following approval from the USFWS and DOFAW.

Beyond Year 2 – Some level of monitoring may be required throughout the operational period of the Project; the scope and frequency of this additional monitoring will be determined by the rate of take documented at the Project and will be subject to the approval of USFWS and DOFAW (Section 7.0).

Table 2-1. Search Frequency by Month in Relation to Seasonality of Petrel and Bat Biology

Topic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Petrel Biology	Petrels not present		Petrel breeding periods							Petrel fledging period		Petrels not present
Bat Biology	Low bat use			Bat breeding season			Peak bat activity at KWP II and Auwahi*					Low bat use
Year 1	1X month	1X month	1X week	1X week	1X week	1X week	2X week	2X week	2X week	2X week	2X week	1X month
Year 2	1X month	1X month	1X week	1X week	1X week	1X week	TBD*	TBD	TBD	2X week	2X week	1X month

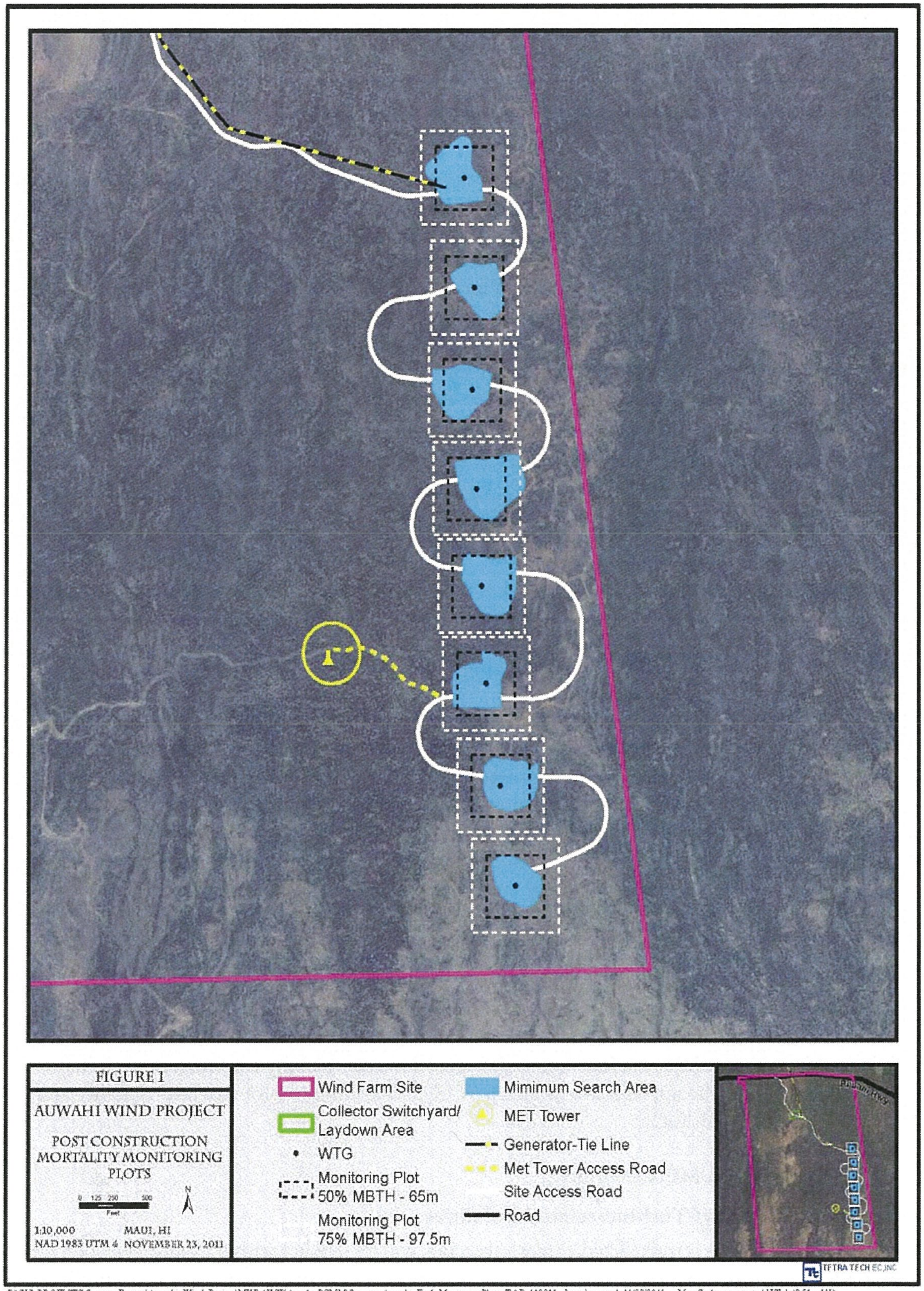
*Year 2 sampling frequency during bat activity period to be determined based on Year 1 data.
TBD – to be determined

2.2 SAMPLING DESIGN

Search Plot Size and Configuration

Based on publicly available results from other post-construction monitoring programs at wind farms in Hawaii and the mainland, the majority of carcasses found during standardized carcass searches around individual WTGs have been found within a distance equal to 50 to 67 percent of WTG height. At the operating Kaheawa I project, 75 percent of carcasses attributed to WTG collisions found to date (including nine carcasses of listed species: three Hawaiian petrel, four nēnē, and two Hawaiian hoary bat) were found within a distance less than 50 percent of the maximum time height of the WTGs where the area searched was 100 percent of WTG height (Hufana, S. pers. com. 2010). At the High Winds Wind Power Project, 96 percent of carcasses were found within two-thirds (67 percent) of WTG height (Kerlinger et al. 2005). Studies conducted at other wind energy facilities indicate that nearly all fatalities are found well within the WTG maximum tip height with over 80 percent of bat carcasses within a distance equal to 50 percent of the maximum distance from the tip height to the ground (Johnson et al. 2003; Young et al. 2003; Erickson et al. 2004; Arnett 2005; Kerns et al. 2005; Jain et al. 2007; Strickland et al. 2011).

The ideal search area for petrel fatalities (i.e., approximately 75 percent of WTG height) would have a radius of 97.5 meter (Figure 1). The WTG has a hub height of approximately 262.5 feet (80 meters) and blade lengths of 165.6 feet (50.5 meters), resulting in a maximum tip height of 428.2 feet (130.5 meters) above ground level (agl). The cleared and maintained turbine pad areas are not uniform among turbines, but are primarily rectangular in shape with sides between 295 and 492 feet (90 and 150 meters) in length (Figure 1). Therefore, portions of each search area not cleared by construction activity remain as rugged terrain. If the full area within the plot is determined not to be searchable based on low searcher efficiency or impassible terrain (depending on existing vegetation), the plot size will be reduced to the searchable area. Search areas will encompass maintained turbine pads and access roads, as well as adjacent unmaintained searchable areas. The actual area searched will be dependent on the configuration of the maintained areas, as well as the portion of the unmaintained area that can be realistically searched as determined during initial surveys (see Search Plot Mapping section below). Prior to conducting the first survey, a sweep survey will be completed within all search plots to clear all pre-existing carcasses from the search area. Ultimately, the monitoring plot sizes may not be consistent across WTGs or uniform in size in order to maximize search area and searcher efficiency. Density-weighted averaging will be used to estimate the number of carcasses that may have fallen in the non-search areas (Strickland et al. 2011; Section 5.0).



P:\GIS_PROJECTS\Sempra_Energy\Auwahi_Wind_Project\MXDs\HCP\Apndx_PCMM\Sempra_Auwahi_Fig1_MonitoringPlots_TabP_112311 - Last Accessed 11/23/2011 - Map Scale correct at ANSI A (8.5" x 11")

The ideal search area for bat fatalities (i.e., approximately 50 percent of WTG height) would have a radius of 65 m, and is a subset of the petrel search area. To maximize searcher efficiency, Auwahi Wind proposes to search all cleared areas within this ideal search area. On average, 58 percent of the ideal search area for each WTG consists of cleared area. Density-weighted averaging will be used to estimate the number of carcasses that may have fallen in the non-search areas (Strickland et al. 2011; Section 5.0).

Some of the terrain where WTGs are proposed is rugged and densely vegetated, which may in some instances make locating carcasses very difficult. Much effort would be spent searching these areas with an anticipated low searcher efficiency rate. Vegetation management would not be cost effective for this site; however, once the WTGs are operational and if it is determined that some vegetation can be managed for a reasonable cost, Auwahi Wind will consider this in order to increase the searchable area and searcher efficiency. Therefore, to maximize the potential for locating carcasses and use of resources, areas will be deemed realistically searchable if they consist of terrain that is safe for searchers to traverse and/or have a searcher efficiency rate of at least 70 percent for seabirds. The total search area for each WTG will be measured post-construction.

Transects will be established within search plots approximately 20 feet (6 meters) apart, adjusted as necessary for vegetation type and visibility, and the searcher will walk along each transect searching both sides out to 10 feet (3 meters) for fatalities. Personnel trained in proper search techniques will conduct the carcass searches. Protocol for documenting any fatalities or injuries is provided in Section 2.3.

The likelihood of collisions with a met tower on site is low. However, standardized searches will be conducted at the same search interval under the met tower within a plot extending 33 feet (10 meters) from the base of the guy wires. Transects will be spaced approximately 20 feet (6 meters) apart, but will be adjusted for vegetation type and visibility.

Search Plot Mapping

The Project site is topographically diverse with some proposed WTG locations in areas where safety issues may render portions of search plots unsearchable and vegetation management not feasible. This search area restriction influences the proportion of the actual fatalities that can possibly be detected (Huso 2010). To better estimate this potential influence, a global positioning system (GPS) will be used to map the boundaries of the actual area searched at each WTG. A density-weighted correction factor, based on this percentage of area searched and on the distribution of found carcasses, will be applied to the fatality estimate (e.g., Arnett 2005; Strickland et al. 2011). The proposed mortality estimator accounts for unequal searchable area across searched WTGs (Section 5.0).

Once the plot size is determined, vegetation types outside the maintained WTG pad within search plots will be mapped and classified according to varying levels of visibility (e.g., Arnett et al. 2009a,b). However, as previously discussed, search plot size and visibility may differ between WTGs. Therefore, it may be appropriate to group WTGs according to plot size and visibility and calculate fatality rates accordingly.

2.3 FATALITY DOCUMENTATION

2.3.1 Documentation of Turbine-related Fatalities

All carcasses found during standardized carcass searches will be labeled with a unique number, and searchers will record: species, sex, and age when possible; date and time collected; location (GPS coordinate and distance/direction from the WTG); condition (intact, scavenged, feather spot); and any comments that may indicate cause of death. If a carcass of a listed species is found, searchers will follow the project Downed Wildlife Protocol (Attachment 1) and complete a Downed Wildlife Incident Report (Attachment 3).

The condition of each carcass found will be recorded using the following categories:

- Intact/Complete—a carcass that is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger.
- Scavenged/Dismembered—an entire carcass or most of a carcass which shows signs of being fed upon by a predator or scavenger, or a portion(s) of a carcass in one location (e.g., wings, skeletal remains, portion of a carcass, etc.), or a carcass that has been heavily infested by insects.
- Feather Spot—ten or more feathers at one location indicating predation or scavenging.

All casualties located will be photographed as found and plotted on a detailed map of the study area showing the location of the WTGs and associated facilities such as overhead power lines and met towers. A copy of the field forms for each carcass will be kept with the carcass at all times in a separate bag, if the carcass is removed from the field (examples provided as Attachments 2 and 3).

Carcasses will be double-bagged and frozen for future reference and possible necropsy or as otherwise directed by USFWS or DOFAW. Carcasses of non-listed species will be left in place or kept for searcher efficiency and/or carcass removal trials, or disposed of at an approved location as appropriate.

Searchers may discover carcasses incidental to formal carcass searches (e.g., while driving within the Project site). For each incidentally discovered carcass, the searcher will identify, photograph, and record data for the carcass as would be done for carcasses found during formal scheduled searches, but will code these carcasses as incidental discoveries.

Any injured native birds or bats found on the Project site will be carefully captured by a trained project biologist or technician and transported to a local USFWS- and DOFAW-approved wildlife rehabilitator (e.g., Maui Animal Rescue and Sanctuary located approximately 30 miles [48 kilometers] from the Project). Auwahi Wind staff conducting the surveys will be trained on how to handle any downed wildlife or carcasses found anywhere within the project area. Furthermore, a Downed Wildlife Incident Report (Attachment 3) will be completed for any injured animal or fatality.

2.3.2 Reporting Procedures

If a carcass of a listed species is found, searchers will follow the project Downed Wildlife Protocol (Attachment 1). This protocol includes agency contact information for reporting project-related incidental takes and from standardized surveys. Searchers will either provide the carcasses to the appropriate entity or store the carcass in the freezer for possible necropsy or take other action as directed by the USFWS and DOFAW. During the first 2 years of monitoring, all carcasses found attributed to incidental or during standardized surveys will be reported to USFWS and DOFAW.

3.0 CARCASS REMOVAL TRIALS

Carcass removal is the disappearance of a carcass from the search area due to scavenging, predation, or other means (e.g., wind, rain, decomposition beyond recognition). As previously discussed, the intensity of fatality searches should be conducted at a frequency that minimizes the amount of extrapolation that would be required in estimating mortality. Seasonal differences in carcass removal rates (e.g., changes in scavenger population density or type) and possible differences in the size of the animal being scavenged are typically taken into account when evaluating carcass removal rates.

The objective of the carcass removal trials is to document the length of time carcasses remain in the search area, and thus are available to be found by searchers, and, subsequently, to determine the frequency of carcass searches within the search plots. Carcass removal trials will be conducted during each season the first 2 years and will be used to adjust carcass surveys for removal bias.

Carcasses used in the trials will be selected to best represent the size, mass, coloration, and will have similar proportions to the Covered Species. For petrels and nene, carcasses may include legally obtained wedge-tailed shearwaters, a close taxonomic relative to Hawaiian petrels, if available; otherwise, commercially available adult game birds or cryptically colored chickens will be used to simulate seabirds. Auwahi Wind will coordinate with DOFAW and USFWS on availability of carcasses to be used during carcass removal trials. Bat carcasses will most likely not be available for scavenging trials, so a surrogate will be used. Carcasses of dark-colored mammals (e.g., small rats or mice) may be used to simulate bats. Legally obtained small passerines (e.g., house sparrows) or commercially available game bird chicks may be considered to simulate bats, although they are not ideal because of their differences in appearance and decomposition rates. Non-listed bird carcasses found during the surveys may be used for these trials.

3.1 SAMPLING INTENSITY

Given that carcass persistence times are currently unknown in the Project site, an initial carcass removal trial will be conducted for seabirds and bats after the Project is operational and just prior to the initiation of the PCMP to determine an initial carcass persistence rate. The search interval during the potential high bat activity period (July – November) will be established as the shorter of two time periods: two times per week or the interval after which at least 90 percent of trial carcasses remain. The resulting carcass removal data will be used during estimation of Project-wide avian and bat mortality. Should the desired search frequency not be met at any time due to reasons other than weather, health, or safety, Auwahi Wind will inform the agencies to discuss a course of action. These occurrences will be documented in annual monitoring reports. At the conclusion of Year 1 monitoring, the search frequency for Year 2 will be determined in consultation with USFWS and DOFAW.

Assuming adequate carcass availability, at least two trials will be conducted per season with up to eight carcasses of each size class (bat and bird) placed per trial, resulting in a total of up to 64 trial carcasses used in carcass removal studies for the entire year for the Project. Seasons will be defined based on the following annual dry and wet seasons experienced in Hawaii: dry season (May through October) and wet season (November through April). The trials will be spread throughout sampling period to incorporate the effects of varying weather, climatic conditions, and scavenger densities. The first trial will be conducted prior to initiating the monitoring program to establish the initial appropriate search interval.

3.2 CONDUCTING THE TRIAL

Each carcass used for the carcass removal trial will be placed at stratified random locations within the Project site near or within the search plots. Prior to initiating the trial, a set of random locations will be generated to determine the location of trial carcasses. These locations will subsequently be loaded into a GPS as waypoints to allow the accurate placement of the carcasses by field personnel. Carcasses will be dropped from waist high and allowed to land in a random posture. Each trial carcass will be discreetly marked (e.g., small tag or wire wrapped around one leg) prior to dropping so that it can be identified as a study carcass if it is found by other searchers or Project personnel.

Personnel conducting carcass searches will monitor the trial birds every day over a 21-day period during the first year of post-construction monitoring. By doing daily checks, Auwahi Wind will know the exact 24-hour period when the carcass is removed. Experimental carcasses will be left at the location until the end of the carcass removal trial.

When checking the carcass, searchers will record the condition as intact (normal stages of decomposition), scavenged (feathers pulled out, chewed on, or parts missing), feather spot (only feathers left), or completely gone. Changes in carcasses condition will be cataloged with pictures and detailed notes; photographs will be taken at placement and any time major changes have occurred. At the end of the 21-day period any evidence of the carcasses that remain will be removed.

3.3 CARCASS REMOVAL RATE ESTIMATION

Estimates of carcass removal rates or the time (measured in days) that carcasses remain on site and are available to be found by searchers are used to adjust carcass counts for removal bias. Mean carcass removal time ($\bar{t}$) is the average length of time a carcass remains in the study area before it is removed:

$$\bar{t} = \frac{\sum_{i=1}^{s} t_i}{s - s_c}$$

where t_i is the time (in days) a carcass remains in the study area before it is removed, s is the number of carcasses used in the trial, and s_c is the number of carcasses in removal trials that remain in the study area at the end of the trial period.

4.0 SEARCHER EFFICIENCY TRIALS

The ability of searchers to detect carcasses is influenced by a number of factors including the skill of an individual searcher in finding the carcasses, the vegetation composition within the search area, and the characteristics of individual carcasses (e.g., body size, color). The objective of searcher efficiency trials is to estimate the percentage of bird and bat fatalities that searchers are able to find. Estimates of searcher efficiency are then used to adjust carcass counts for detection bias. Searcher efficiency trials will be conducted during each season of the survey period during the first 2 years of monitoring to account for seasonal differences in searcher efficiency. Carcass acquisition for searcher efficiency trials will be the same as that described for carcass removal trials.

4.1 SAMPLING INTENSITY

Searcher efficiency trials will begin when WTGs are placed into operation and standardized carcass searches start. Personnel conducting the searches will not know when trials are conducted or the location of the detection carcasses. Trials will be conducted at least two times for each of the two seasons and will incorporate testing of each member of the field crew. Carcasses from both size classes (seabird and bat) will be included in the trials. A minimum of five carcasses per size class will be used in each trial. The number of trials conducted per season will be dependent upon carcass availability.

4.2 CONDUCTING THE TRIAL

All carcasses will be placed at stratified random locations within areas being searched prior to the carcass search on the same day so that searchers are not aware they are being tested. Carcasses will be dropped from waist high or higher and allowed to land in a random posture. Each trial carcass will be discreetly marked (e.g., small tag or wire wrapped around one leg) prior to dropping so that it can be identified as a study carcass after it is found. The number and location of the detection carcasses found during the carcass search will be recorded. The number of carcasses available for detection during each trial will be verified immediately after the trial by the person responsible for distributing the carcasses.

4.3 SEARCHER EFFICIENCY RATE ESTIMATION

Searcher efficiency rates will be estimated by searcher, carcass size and types, WTG, and season. These rates are expressed as p, the proportion of trial carcasses that are detected by searchers in the searcher efficiency trials, as provided in the fatality rate calculation discussion in Section 5.0.

5.0 FATALITY RATE CALCULATION

The estimate of total direct take will incorporate observed mortality, documented during standardized carcass searches, as well as unobserved mortality, or individuals that may have been killed by interactions with Project components but are not found by searchers for various reasons.

Specifically, fatality estimates will be calculated for seabirds and will take into account:

- Search interval;
- Searchable area around each searched turbine;
- Observed number of carcasses found during standardized searches during the monitoring year for which the cause of death can be attributed to facility operation;
- Carcass removal rates, expressed as the estimated average number of days a carcass is expected to remain in the study area and be available for detection by the searchers during removal trials; and
- Searcher efficiency, expressed as the weighted average proportion of planted carcasses found by searchers during searcher efficiency trials.

There have been many recent advances in post-construction monitoring techniques and fatality rate estimates, and there are a number of estimators available for calculating fatality rates. These estimators provide different methods to account for unobserved mortality, with some estimators treating searcher efficiency and carcass removal as separate factors and others treating them as interrelated (e.g., Shoenfeld 2004; Jain et al. 2007; Huso 2010). However, the most recent estimator developed by Huso (2010) is expected to be used until improvements to estimating fatality rates are available. Huso's estimator will improve the potential for reducing the inherent biases in the data and provide the ability to account for variable search ability (e.g., based on vegetation types or unsearchable areas) within the search plot. Take can also be calculated per turbine and per interval while adjusting for variables such as actual area searched or visibility class. The Huso (2010) estimator can be expressed as:

$$\hat{M} = \frac{c}{\hat{a}\ \hat{r}\ \hat{p}\ \hat{e}}$$

Where:

M = estimated total direct mortality
c = observed number of carcasses
a = the estimated density-weighted proportion of the plot searched
r = estimate of proportion of carcasses remaining after scavenging (scavenger efficiency)
p = estimated searcher efficiency (proportion of carcasses found)
e = effective search interval (days) calculated as the ratio of (days before 99 percent of carcasses can be expected to be removed/search interval) or 1, whichever is less.

6.0 WILDLIFE EDUCATION AND INCIDENTAL REPORTING PROGRAM

Auwahi Wind will implement a Wildlife Education and Incidental Reporting program for contractors, Project staff members, and other 'Ulupalakua Ranch staff who are on site on a regular basis. This training enables staff to identify the Covered Species that may occur in the Project area, record observations of these species, and take appropriate steps for documentation and reporting when any Covered Species is encountered during construction or operation of the Project including when downed birds or bats are found. The Wildlife Education and Incidental Reporting program will facilitate incidental reporting of observations within the Project site, as well as within the generator-tie line corridor where Auwahi Wind staff and 'Ulupalakua Ranch are regularly present during the course of normal Project and ranch operations. Incidental reporting will inform the Project post-construction monitoring program of any wildlife fatalities that occur outside of standardized fatality surveys within the Project, as well as providing supplementary information on impacts associated with the generator-tie line where standardized post-construction monitoring will not occur. The program will be prepared by a qualified biologist and will be approved in advance by the USFWS and DOFAW. Over the term of this HCP, the program will be updated as necessary.

The program will include wildlife education briefings to be attended by new Project staff and other contractors or ranch staff as appropriate. Staff members will be provided with printed reference materials that include photographs of each of the Covered Species and information on their biology and habitat requirements; threats to the species on site; and measures being taken for their protection under this HCP. The Project Biologist, who will coordinate the post-construction monitoring on site, will coordinate with the Construction Foreman and the Project Operations Manager to ensure that personnel receive the appropriate written material.

Staff members will be responsible for responding to and treating wildlife appropriately under all circumstances, including avoiding approaching any wildlife other than downed wildlife and avoiding any behavior that would harm or harass wildlife (including feeding). In conjunction with regular assigned duties, personnel will be responsible for:

- Recording any project-related wildlife incidents;
- Adhering to Project area road speed limits;
- Identifying Covered Species when possible (Hawaiian petrel, nēnē, Hawaiian hoary bat, and Blackburn's sphinx moth) and documenting observations by filing a Wildlife Observation Form; and
- Identifying, reporting, and handling any downed wildlife in accordance with the Downed Wildlife Protocol, including filing a Downed Wildlife Incidence Report form (Attachment 3).

7.0 SAMPLING BEYOND THE INITIAL TWO-YEAR PERIOD

Sampling duration, plot size, and survey intensity may be modified upon completion of the initial 2 years of monitoring or sooner, subject to approval by USFWS and DOFAW. It is anticipated that surveys conducted during the first 2-year period will provide sufficient data on take to adequately describe carcass distribution and spatial and temporal trends in fatalities within the Project area. The PCMP data may provide justification for modifying search plot size, search frequency, or the number of WTGs searched, or for concentrating sampling efforts at specific WTGs or during certain times of year during subsequent years of monitoring. These data will also illustrate trends in searcher efficiency and carcass removal over time.

Should the documented searcher efficiency drop below an average of 50 percent, Auwahi Wind will collaborate with the USFWS and DOFAW to develop alternative search strategies (e.g., intensive vegetation management, trained search dogs). A searcher efficiency of 25 percent is considered to be the minimum required for statistical validity (Strickland et al. 2011).

Auwahi Wind proposes a long-term monitoring approach consisting of periodic intensive monitoring followed by interim years of less intensive but systematic monitoring. Intensive monitoring would occur every 5 years after the initial 2-year intensive sampling period (i.e., years 7, 12, 17, and 22), resulting in a total of 6 years of intensive monitoring during the life of the Project (Table 7-1). During intensive monitoring years, searcher efficiency trials and carcass removal trials would be conducted to determine if any variables have changed over time and if any modifications to search frequency are required (Table 7-1). During interim years, assuming trends in the monitoring data provide confidence in the estimate of take, the monitoring effort would be reduced to conducting systematic carcass surveys on a monthly or other less frequent basis. The frequency at which the surveys take place during interim years will be determined at the conclusion of the carcass removal trials for that 5-year period. It is assumed that searcher efficiency trials may have to be conducted more frequently depending on changes in staff. All adjustments to direct take during interim years would use the most recent estimates from the searcher efficiency and carcass removal trials. Revised methods will be evaluated in cooperation with USFWS and DOFAW.

Table 7-1. Schedule of Post-Construction Monitoring over the ITP/ITL Term

Year of Permit Term	Standardized Carcass Searches	Searcher Efficiency and Carcass Removal Trials
1	Intensive Monitoring	X
2	Intensive Monitoring	X
3-6	Systematic Monitoring	--
7	Intensive Monitoring	X
8-11	Systematic Monitoring	--
12	Intensive Monitoring	X
13-16	Systematic Monitoring	--
17	Intensive Monitoring	X
18-21	Systematic Monitoring	---
22	Intensive Monitoring	X
23-25	Systematic Monitoring	--

This approach is designed to inform Auwahi Wind where take levels are in relation to the established tiers outlined in the HCP and to provide a mechanism for continually assessing and adjusting the sampling scheme to ensure data accuracy. Continuous standardized monitoring will provide shorter-term benchmarks for evaluating whether take is higher or lower than anticipated over a several-year period, recognizing that take may fluctuate during years of operation. Thus, Auwahi Wind will be able to gauge easily when a given tier of take is being approached, signaling the need to engage the USFWS and DOFAW in additional discussions regarding Project status and to begin preparation for implementation of additional mitigation. This information will be used to inform any other decisions related to adaptive management as described in the HCP.

8.0 REPORTING

An annual report for the Project will be submitted to USFWS and DOFAW. The report will include the following:

- A summary of the results of the post-construction monitoring surveys including a list of detected carcasses;
- Results of the carcass removal trials and searcher efficiency trials;
- Documented take, if any, of each covered listed species;
- The identification of any recommended changes to the monitoring protocols, and
- Any proposed protocol modifications.

The reporting schedule is outlined in the Monitoring section of the HCP.

A Downed Wildlife Incident Report will be filed with the USFWS and DOFAW within 3 business days (Attachment 3) of the discovery of a federally and state-listed species and cumulative adjusted take will be reported to the agencies within 3 weeks. Auwahi Wind will consult with the USFWS and DOFAW to review take limits and will discuss changed circumstances or adaptive management measures as necessary. Carcasses of non-listed species will be reported to DOFAW and USFWS on a monthly basis.

SUPPLEMENT: THE AUWAHI HCP AMENDMENT LONG-TERM POST CONSTRUCTION MORTALITY MONITORING PLAN

Auwahi Wind has completed the initial intensive period of monitoring as described above in the original PCMP. The PCMP was developed with the best science available at the time. Information gained from the initial 5 years of morning at the Project as well as the current best available science has been used to revise the protocol as described below in the long-term post-construction mortality monitoring plan.

9.0 INTRODUCTION

This supplement to the original PCMP describes the long-term post-construction mortality monitoring plan (Plan) to be implemented at the Auwahi Wind Farm Project (Project). Under the approved Project Habitat Conservation Plan (HCP; Tetra Tech 2012), Auwahi Wind Energy, LLC (Auwahi Wind) committed to conducting Intensive Monitoring during the first 2 years of Project operations, after which time initial post-construction mortality monitoring data and other site-specific considerations would be used to adaptively manage the monitoring program. This appendix outlines the approach to post-construction mortality monitoring over the remainder of the 20 year operating term of the Project's 25-year Incidental Take Permit (ITP)/Incidental Take License (ITL) term (permit term) while the turbines are operational. It serves as a supplement to the Project's Post-Construction Monitoring Plan. Recent advancements in the science of wind farm post-construction mortality monitoring since 2012 have been incorporated as appropriate.

The approach to long-term mortality monitoring consists of Systematic Monitoring throughout the remainder of the permit term while turbines are operational, with the potential to adaptively manage the Plan in consultation with the USFWS and DOFAW. The primary purpose of Systematic Monitoring (as well as previous Intensive Monitoring efforts) is to collect standardized mortality data that can be used to develop an estimate of adjusted take (estimated take) of the Hawaiian hoary bat attributable to Project operations) and enable the comparison of estimated take relative to authorized take limits under the ITP/ITL. Estimated take accounts for observed direct take, unobserved direct take, and indirect take. These terms are defined as follows and described in detail in Section 2:

- **Intensive Monitoring**—Standardized carcass searches conducted in full-sized search plots designed to include the majority of large bird and bat fatalities. Search plots centered on Project wind turbines. Bias correction trials conducted (searcher efficiency and carcass persistence). Data used to estimate take for Intensive Monitoring periods.
- **Systematic Monitoring**—Standardized carcass searches conducted within refined search plots excluding hazardous areas to traverse (roads and pads within 328 feet [100 meters] of turbines). Bias correction trials conducted (searcher efficiency and carcass persistence; see Section 3 for additional detail). Data used to estimate take for Systematic Monitoring periods.

Intensive Monitoring at the Project began in January 2013 and was completed in January 2015. Implementation of Systematic Monitoring was approved by USFWS and DOFAW and implemented in January 2015 to increase the efficiency of the monitoring effort and address site-specific safety concerns (see the December 12, 2014 meeting minutes [Auwahi Wind 2014a] and FY 2015 annual report [Auwahi Wind 2015] for details). The following sections describe the long-term mortality monitoring timeline, Systematic Monitoring, adaptive management, and updated reporting requirements.

10.0 LONG-TERM MONITORING SCHEDULE

This section describes the schedule for long-term mortality monitoring over the remainder of the Project's permit term. As noted above, beginning in January 2015 Systematic Monitoring (described in Section 3) was initiated which incorporated standardized searches of roads and turbine pads to establish a baseline estimate of take following implementation of turbine low wind speed curtailment. A spike in observed bat fatalities in the summer of 2016 under low wind speed curtailment suggested that inter-annual variability in fatality rates at the site may require a relatively long monitoring period to understand patterns of bat fatalities at the Project. Prior to February 2015, low wind speed curtailment had not been implemented. Systematic Monitoring provides opportunities to document temporal changes in annual fatality rates. Systematic Monitoring will continue until results reveal predictable patterns of fatalities, at which point this Plan may be adapted in consultation with USFWS and DOFAW.

The following provides an overview of the long-term mortality monitoring schedule by year of commercial operation:

- Years 1 and 2 – Intensive Monitoring was conducted as described in Appendix E of the approved Project HCP with results reported in FY 2013, 2014, and 2015 annual compliance reports (Tetra Tech 2013; Auwahi Wind 2014b, 2015). The estimated take from these years is assumed to be representative of take without implementation of low wind speed curtailment.
- Years 3 through 20 – Routine Systematic Monitoring will be conducted during all months of the year as appropriate for the search type. Alterations to the search routine may be determined to be necessary based on the results of carcass persistence trials or the Plan may be adjusted in consultation with USFWS and DOFAW.
- Years 21 through 25 – No monitoring is scheduled during the final 5 years of the permit term. Turbines are anticipated to be inactive because the power purchase agreement expires after 20 years of commercial operation. If the Project continues to operate during this period, Systematic Monitoring will be implemented while the Project is operating, unless a modification to the Plan is developed in consultation with USFWS and DOFAW.

11.0 SYSTEMATIC MONITORING

11.1 SEARCH AREA AND PROTOCOL

The search areas for Systematic Monitoring consist of roads and graded pads that occur within a 328-foot (100-meter) radius of each of the Project turbines. Although the search plot size and configuration varies among turbines, an analysis of the expected carcass distribution around each turbine indicates that the total search area encompasses approximately 76 percent of the overall distribution of bat carcasses and approximately 56 percent of the carcass distribution for large birds (Strickland et al. 2011).

Procedures for conducting Systematic Monitoring follow those used for Intensive Monitoring and include weekly searches. Canine search teams will be used primarily. No search transects are established. An expert canine handler and canine team is used to survey the search area. The search area is delineated by the HCP Manager and provided to the canine team. The searcher uses experience and environmental conditions to cover the search area. In the event the canine search team is unavailable, human searchers will be used. When human searchers are used, they will be using transects. Within each search plot, transects are established approximately 20 feet (6 meters) apart. Vegetation control will be maintained within the search plots during years of Systematic Monitoring to maximize visibility. Personnel trained in proper search techniques conduct the carcass searches by walking along each transect and scanning both sides out to 10 feet (3 meters) for fatalities.

11.2 FATALITY DOCUMENTATION

Procedures for documenting observed fatalities largely follow those described in the PCMP of the approved Project HCP; however, a subsequent release by DOFAW of a standardized protocol for response to downed birds and bats (Attachment 1) has resulted in revised procedures that supersede those previously described.

11.3 CARCASS REMOVAL AND SEARCHER EFFICIENCY TRIALS

Carcass removal and searcher efficiency trials estimate biases in carcass detectability. These trials will be conducted during the periods of Systematic Monitoring and results will be used to derive adjusted take estimates as described in the PCMP of the approved Project HCP (see Section 5) and as clarified here (Section 4).

Carcass removal trials will be conducted at least twice per season (twice during the wet season and twice during the dry season) and will include a minimum of 10 large birds and 10 medium-sized rats per trial (or appropriate surrogate species). This seasonal sample size results in a goal of 80 trial carcasses (40 per size class) for an entire year, should sufficient carcasses be available. Trials will last a minimum of 21 days and will consist of daily checks for the first 7 days followed by checks every other day until then end of the trial to document the presence or absence of each carcass throughout the trial period or until carcasses are no longer detected. Because of low carcass persistence documented during the Intensive Monitoring period, predator control measures (trapping) were initiated in November 2013 and is anticipated to continue during periods of Systematic Monitoring.

Searcher efficiency trials will be conducted a minimum of three times during each of the two seasons and spaced out within each survey season to capture the potential effects of varying weather and vegetation growth. Carcasses from two size classes (large birds and rats) will be included in the trials resulting in a goal of 60 trial carcasses (30 per size class) for an entire year, should sufficient carcasses be available.

12.0 ANALYSIS AND INTERPRETATION

Auwahi Wind will use an appropriate USFWS- and DOFAW-approved analytical tool to estimate take of Covered Species. As described in the approved Project HCP, direct take of Covered Species will be estimated by using statistical models that adjust the number of observed fatalities for detection bias inherent in mortality monitoring. Model inputs (searcher efficiency, carcass persistence, etc.) will be based on data collected during each monitoring period. Estimates of indirect take, based on the seasonal patterns of fatalities and assumptions about Covered Species' life history data, are added to estimated direct take to develop the estimated take for the Project (see approved Project HCP and Section 5.1.2 of the HCP Amendment). The approach to estimating take for Nene and Hawaiian petrel is described in the approved Project HCP and the Project Post-Construction Monitoring Plan.

This section summarizes the analysis and interpretation of bat fatalities and supersedes the approach described in the approved Project HCP and the Post-Construction Monitoring Plan. A more comprehensive explanation of the approach, statistical parameters, interpretation, and justification are provided in Appendix H of the HCP Amendment. At this time, based on small numbers of bat fatalities observed during the two years of Intensive Monitoring and three years of Systematic Monitoring, Auwahi Wind anticipates that the statistical model used to account for direct take would be the Dalthorp et al. (2017) Evidence of Absence statistical tool. However, if a minimum sample size of 5 to 10 fatalities are observed during a monitoring period, the estimated direct take instead would be derived using the Huso estimator (Huso 2010; Huso et al. 2012). Finally, should new suitable and peer-reviewed approaches to estimating direct take or fatality rates become available, Auwahi Wind will work with USFWS and DOFAW to assess whether an alternate approach should be considered

The Evidence of Absence tool creates a probability distribution of the number of potential direct fatalities. Information from previous years "inform" the current probability distribution, allowing for the development of more accurate probability distributions through on-going monitoring. The output provides the user with the levels of confidence that take estimates at a defined credibility level would not be exceeded over the permit term. Results are a function of the credibility level, observed fatalities, and past and projected future monitoring efforts. An 80 percent credibility level has been required by USWS and DOFAW to assess compliance with an ITP/ITL and provides a high level of confidence that actual take would not exceed the estimated take. Comparison of estimated direct take plus indirect take with ITP/ITL authorized take limits or tier limits enables the assessment of compliance with the ITP/ITL.

Indirect take will be accounted for generally using the approach as outlined in Section 5.1.2 of the HCP Amendment, but accounting for the actual status of known fatalities. Specifically, parameters recommended in USFWS and DOFAW guidance (USFWS 2016) will be used to estimate indirect take for bat fatalities. Specifically, indirect take for unobserved direct take is the product of the estimate of unobserved take, the proportion of this take that is assumed to be female (0.5), the proportion of these fatalities that are assumed to occur during the pup dependency period (3/12), and the average number of pups produced (1.8). Genetic samples from all observed fatalities will be collected and results used to determine the sex of observed fatalities during the period when females could have dependent young (April 1 – September 15). Prior to the determination of the sex of a fatality during the dependency period, the probability of it being a female will be estimated to be 50 percent. Following the results of genetic testing or other information identifying the sex of an individual bat fatality, indirect take estimates will be updated to reflect the most current information, with confirmed female fatalities found between April 1 and September 15 assumed to have had dependent young. No indirect take will be ascribed to males or any female taken between April 1 and September 15 that were determined to not have dependent young. Total take will be calculated by adding indirect take in terms of adult equivalents (based on an assumed survival rate of juveniles to adulthood of 0.3) to the estimate of direct take (described above).

Fatalities found incidentally to standardized searches are those found outside the search plots. These fatalities will be reported but not included in the calculation of estimated take, as the statistical models include adjustments (i.e., proportion of the carcass distribution searched) that account for carcasses that fall outside of the search plots. The most appropriate method for including incidental fatalities found within the search plots but outside of standardized searches is to include them as a probability function based on study parameters. If such a carcass was not found incidentally, it would have been subject to loss described by carcass persistence parameters (alpha and beta), and detected with the searcher efficiency probability of detection (p) multiplied by the decrease in efficiency per subsequent search (k), and accounted for in the a priori distribution used to model future takes. The USFWS has provided guidance on the incorporation of fatalities found incidentally within the search area. This guidance, subsequent guidance, or other methods mutually agreed upon by Auwahi Wind, USFWS and DOFAW will be used by Auwahi in assessing indirect take:

> If a carcass is found incidentally, then it must be determined if the carcass would have been found on the next routine search day and therefore counted as Observed, or if the carcass would have been missed or be gone on the next routine search and accounted for in the Unobserved portion of fatalities." The Hawaiian hoary bat carcasses are important to ongoing genetic research, so leaving the listed carcass in place is not in the best interest for the species. If a carcass is found incidentally, in the designated search area the Downed Wildlife Protocol and reporting should be followed. The report should clearly indicate who found the carcass, and under what circumstances (turbine maintenance, weeding, mowing, etc.). The report should also indicate the method of determining how to categorize the carcass. The three methods are:

1) Permittee chooses to include the carcass as Observed in the model, regardless of searcher efficiency.

2) Wildlife agencies will include the carcass as Observed in the model when the documented detection probability is sufficiently high so as to reasonably assume the carcass would have been found on a subsequent scheduled search. Specifically, this method makes the assumption that the search efficiency and *k* value are such that there is a high probability that the carcass would have been found on a subsequent search. This method will be used for all large and medium carcasses found. This method will also be used for smaller carcasses when it is reasonable to assume the carcass or carcass trace would have been found on a subsequent search. The wildlife agencies will assume a carcass would have been found when the documented searcher efficiency $\geq$75 percent and *k* value ≥ 0.7.

In the case of small carcasses where the searcher efficiency is less than 75 percent (based on permittee's documented efficacy), a double-blind search with a replacement surrogate should be conducted to determine how the recovered carcass shall be categorized: Observed or Unobserved. That trial shall include the following criteria:

a. The surrogate (typically a rat) should be identical to that used for search efficacy trials and similar in size to the carcass found.
b. The surrogate carcass should be labeled as a surrogate for the specific carcass it is representing, and placed by a third party in the proximity of where the carcass that was recovered was found with label hidden.
c. The placement of this carcass should be conducted by the same party responsible for placing carcasses for efficiency trials, whenever possible.
d. Under no circumstances should the searcher conducting the routine search, be the one placing the surrogate or have knowledge of the surrogate's location or the timing of the placement.

e. Routine fatality searches should be carried out following standard search procedures.
f. The outcome of the trial should be reported in the compliance report and include the date the surrogate was placed and the date the carcass was found. If the carcass was never found, the third party should check on the status of the carcass. If the carcass is still present, leave it in place for subsequent searches. Include this information in the compliance report.
g. If the surrogate was found, the original carcass should be reported as Observed. If the surrogate was not found, the original carcass should be reported as Unobserved.

The post-construction mortality monitoring data will provide the information necessary to assess compliance with authorized levels of incidental take and to determine when additional mitigation should be initiated.

13.0 ADAPTIVE MANAGEMENT

This Plan provides an adaptive management approach to the long-term mortality monitoring program. The monitoring approach outlined above may be modified over the permit term, as Project-specific information is obtained, to maximize the effectiveness and efficiency of the monitoring program and to apply the best available science. Project-specific post-construction mortality monitoring results may provide justification for modifying the mortality monitoring protocol including adjustments to survey intensity and/or the long-term mortality monitoring schedule.

Advancements continue to be made in the science of post-construction mortality monitoring particularly with statistical tools to assess bias correction factors and fatality rates (Shoenfeld 2004; Jain et al. 2007; Arnett et al. 2009; Huso 2010; Huso et al. 2012, 2015; Dalthorp and Huso 2017). Additionally, monitoring protocols and technologies for fatality detection, as well as measures for avoidance and minimization of fatalities, will continue to evolve during the course of the permit term and may warrant adjustments to the Plan. In order to maintain a scientifically reliable and cost-effective approach to post-construction mortality monitoring, the Plan may be modified by Auwahi Wind with review and approval from USFWS and DOFAW.

Additionally, Project-specific post-construction mortality results may indicate the need for wind farm operational changes. The following sections outline specific triggers and associated adaptive management measures.

13.1 ADAPTIVE MANAGEMENT OF THE LONG-TERM MONITORING PROGRAM

Systematic Monitoring data will be evaluated on an annual basis to determine if changes to the protocol are necessary. Auwahi Wind would reevaluate the monitoring protocol if a combination of search parameters (Interval, Area, SEEF, and CPT) cause the overall detection probability (Ghat) value to fall below 0.30. In response Auwahi Wind may increase search frequency, intensify predator control measures, and/or increase vegetation management efforts within the search plots to better assess causes and patterns of mortality of the Covered Species.

Under adaptive management Auwahi Wind has made the following changes to minimize impacts and improve post-construction mortality monitoring:

- Under the recommendation of USFWS/DOFAW, Auwahi Wind continues to implement scavenger control at the site. Predator traps are deployed across all turbine search plots (turbine 4 was removed in October 2016 and returned to service February 2018) and used year-round to remove scavengers and increase carcass persistence. Carcass persistence has increased across the site as a result.
- Beginning in January 2015, Auwahi Wind implemented quarterly vegetation management on pads and roads to increase visibility during fatality searches. Vegetation is cut back and maintained at 2 to 4 inches (50 to 100 millimeters) along pads and roads year-round. These efforts have increased the detectability of carcass surrogates during searcher efficiency trials. Monthly vegetation management efforts were initiated in March of 2017.
- Beginning in January 2015, Auwahi Wind switched to systematic searching of pads and roads within a 100-meter buffer of the turbine. Searcher efficiency and carcass persistence trials continue within this area to better refine fatality estimations for the life of the Project.
- Beginning in January 2018, Auwahi wind began to use a canine team to conduct fatality searches once time per week and plans to continue the use of canines for regular searches.

In addition, the development of an effective commercially-available and economical technology to detect turbine collisions, higher than anticipated levels of searcher efficiency or carcass persistence, or new information on the spatial distribution of carcasses could suggest reductions in search area or frequency of searches, or other modifications to the Plan.

14.0 ANNUAL REPORT

An annual report for the Project will be submitted to USFWS and DOFAW following the schedule outlined in the Monitoring section of the HCP Amendment. Auwahi Wind will consult with the USFWS and DOFAW to review take limits and will discuss changed circumstances or adaptive management measures as necessary (Section 5).

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ATTACHMENT 1

DOWNED WILDLIFE PROTOCOL

DOWNED WILDLIFE PROTOCOL

STANDARD PROTOCOL FOR HOLDERS of a State of Hawai`i INCIDENTAL TAKE LICENSE and U.S. Fish and Wildlife Service INCIDENTAL TAKE PERMIT RESPONDING TO DEAD OR INJURED BIRDS AND BATS THAT ARE THREATENED AND ENDANGERED SPECIES OR MBTA SPECIES

[For species not listed as endangered or threatened or MBTA use the downed wildlife form at the end of this document]

Do not move wildlife unless in imminent danger.
Call DOFAW immediately for your island using the phone numbers in Attachment 1

Fill out information on the downed wildlife form using the version with the same date as this protocol and send as directed later in this protocol

OVERVIEW

The islands of Hawai`i 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 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.

Always be prepared for discovery of downed birds and bats. Please ensure that all staff and personnel are trained in this 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 Hawai`i Division of Forestry and Wildlife (DOFAW) Office. The DOFAW staff is generally able to respond by sending someone to the scene to retrieve the injured or deceased wildlife. If DOFAW staff cannot be reached, you must leave a message and call-back number. In the event that DOFAW personnel are reached but not able to respond right away, they may instruct those reporting the incident to provide necessary response. Follow their directions carefully.

If DOFAW staff cannot be contacted, especially if the downed animal is in imminent danger, you should be prepared to handle the animal yourself, following the protocol, 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.

DOWNED WILDLIFE PROTOCOL

PREPARING TO RESPOND FOR DOWNED OR INJURED BIRDS AND BATS

In all cases, ensure that all field staff are 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.

Non-governmental parties should make prior arrangements, including procedures and payments with the rehabilitation or veterinary care facilities that will be used to treat injured animals.

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).

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 or bat.

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.

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 island biologist at the appropriate numbers listed in Attachment 1.

IF YOU FIND A LISTED OR MBTA BIRD OR BAT WHICH IS INJURED AND 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 the DOFAW island biologist immediately at the number in Attachment 1**. Contact information is in prioritized order; if you don't reach the first person on the list, you must call the next. If possible, have someone stay with the animal while someone else calls. If there is no response from either party the animal may be picked up and transported to a qualified care facility after documenting key information and taking photos. 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.
3. 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, 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.
4. 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.

DOWNED WILDLIFE PROTOCOL

5. Transportation of the animal to DOFAW per coordination with DOFAW staff may be required as soon as possible.
6. Notify HCP staff of DOFAW at the Honolulu office and USFWS within 24 hours via email.
7. Fill out a Downed Wildlife Form (us the version with the same date as this protocol) and report to the appropriate official(s) including DOFAW and USFWS HCP staff within 3 days.
    a. For DOFAW send to the following email addresses: dofaw.hcp@hawaii.gov; glenn.m.metzler@hawaii.gov
    b. For USFWS send to the following email addresses:
        i. For O`ahu and Kaua`i: jiny_kim@fws.gov, and cc: diane_sether@fws.gov, jenny_hoskins@fws.gov, Victoria_owens@fws.gov, and keith_swindle@fws.gov
        ii. For Maui, Moloka`i, Lana`i, and Hawai`i: diane_sether@fws.gov and cc: jenny_hoskins@fws.gov, Victoria_owens@fws.gov, and keith_swindle@fws.gov
8. 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.

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

9. 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.
10. 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 the DOFAW island biologist immediately at the number in Attachment 1.** Contact information is in prioritized order; if you don't reach the first person on the list, you must call the next. If possible, have someone stay with the animal while someone else calls. If there is no response from either party the animal may be picked up and transported to a qualified care facility after thoroughly documenting the situation in the downed wildlife form and taking appropriate photos.
11. 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.
12. 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.
13. Notify HCP staff of DOFAW at the Honolulu office and USFWS within 24 hours of discovery via email.
14. Fill out a Downed Wildlife Form (use the version with the same date as this protocol) and report to the appropriate official(s) including DOFAW and USFWS HCP staff within 3 days.
    a. For DOFAW send to the following email addresses: dofaw.hcp@hawaii.gov; glenn.m.metzler@hawaii.gov
    b. For USFWS send to the following email addresses:
        i. For Oahu and Kauai wildlife: jiny_kim@fws.gov, and cc: diane_sether@fws.gov, jenny_hoskins@fws.gov, Victoria_owens@fws.gov, and keith_swindle@fws.gov
        ii. For Maui, Molokai, Lanai, and Hawaii wildlife: diane_sether@fws.gov and cc: jenny_hoskins@fws.gov, victoria_owens@fws.gov, and keith_swindle@fws.gov

DOWNED WILDLIFE PROTOCOL

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 OR MBTA 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, include photo documentation**.
2. **Call the DOFAW island biologist immediately at the number in Attachment 1**. Contact information is in prioritized order; if you don't reach the first person on the list, you must call the next. **Do not** move or collect the wildlife unless directed to do so by DOFAW. 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). 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.
3. If the DOFAW island biologist primary and secondary contacts (at the numbers in Attachment 1) cannot be reached within 1 hour, the carcass should be double bagged and placed in the refrigerator, not the freezer, until appropriate disposition is determined by the wildlife agencies. However, if the carcass is clearly from a wind energy turbine collision it can be placed directly in the freezer. The island biologist must still be contacted and when reached their instructions followed.
4. Also notify HCP staff of DOFAW at the Honolulu office and USFWS within 24 hours of discovery via email.
5. DOFAW island biologists will determine if the carcass should be submitted to the National Wildlife Health Center Honolulu Field Station (Dr. Thierry Work) for necropsy. The general considerations are as follows: if the fatality appears atypical for the species and situation the carcass may be a candidate for necropsy. If cause of fatality is questionable DOFAW or USFWS HCP biologists should provide instructions on how to proceed.
6. Fill out a Downed Wildlife Form (use the version with the same date as this protocol) and send to the appropriate official(s) including DOFAW and USFWS HCP staff within 3 days.
    a. For DOFAW send to the following email addresses: dofaw.hcp@hawaii.gov; glenn.m.metzler@hawaii.gov
    b. For USFWS send to the following email addresses:
        i. For O`ahu and Kaua`i wildlife: jiny_kim@fws.gov cc: diane_sether@fws.gov, jenny_hoskins@fws.gov, victoria_owens@fws.gov, and keith_swindle@fws.gov
        ii. Maui, Moloka`i, Lana`i, and Hawai`i wildlife: diane_sether@fws.gov, and cc: jenny_hoskins@fws.gov, victoria_owens@fws.gov, and keith_swindle@fws.gov

Attachment 1. Contact List for Downed Wildlife Protocol for DOFAW Island Biologists

Island	Primary Contact	After business hours/weekends
Maui	(808) 984-8100 (First Primary Contact) [Secondary: (808) 268-5087, (808) 870-6344, (808) 280-4114 (seabirds)]	(808) 870-6344, (808) 268-5087, (808) 280-4114 (seabirds)
Moloka`i	(808) 553-1745, (808) 870-7598	(808) 870-7598
Lana`i	(808) 565-7916, (808) 357-5090	(808) 357-5090
East Hawai`i	(808) 974-4221	(808) 640-3829
West Hawai`i	(808) 887-6063	(808) 339-0983
O`ahu	(808) 973-9786, (808) 295-5896	(808) 295-5896, (808) 226-6050
Kaua`i	(808) 274-3433 (808) 632-0610, (808) 635-5117 [Secondary: (808) 212-5551 for Kaua`i Seabirds HCP and KIUC Short-term HCP]	(808) 645-1576, (808) 635-5117

Downed Wildlife Forms on the following pages:

Downed Wildlife Incident Documentation and Reporting Form for LISTED and MBTA SPECIES
Downed Wildlife Form for Species NOT LISTED or MBTA

ATTACHMENT 2

CARCASS SURVEY FIELD FORMS

Auwahi Wind Farm Project Post-construction Monitoring Field Form

Date (MM/DD/YYYY) ____________ **Surveyors** ________________

Precipitation ______ (L) light rain (R) rain (D) dry (F) fog **Cloud Cover** _____ (C) clear (P) partly cloudy-25% (L) light-50% (M) moderate-75% (H) high-100%

Wind _____ (0) <0 mph (1) leaves barely move (2) leaves rustle/sm. twigs move (3) sm. twigs move (4) sm. branches move (5) lg. branches move/trees sway (6) variable

Standardized Carcass Searches

Tower No./Met tower[1]	Search Plot (50 or 75 %)	Start Time	End Time	Total Minutes	Fatalities Detected[2]	Other Observations (other wildlife, tracks, sign)
		___:___	___:___			
		___:___	___:___			
		___:___	___:___			
		___:___	___:___			
		___:___	___:___			
		___:___	___:___			
		___:___	___:___			
		___:___	___:___			
		___:___	___:___			
		___:___	___:___			
		___:___	___:___			
		___:___	___:___			
		___:___	___:___			
		___:___	___:___			
		___:___	___:___			
		___:___	___:___			

[1] If a scheduled carcass search cannot be conducted due to weather or other safety concerns note the tower number and provide justification.

[2] List unique identifying number to correspond with casualty mmddyyyy_ turbine#_species code_ # (optional if more than one carcass of the same species is found)

ATTACHMENT 3

DOWNED WILDLIFE INCIDENT REPORT

Downed Wildlife Incident Documentation and Reporting Form
LISTED and MBTA SPECIES

Facility Name:
Species Common Name:
Species Scientific Name:
Four Letter Code: [common name, e.g. HOBA for the Hawaiian Hoary Bat; contact DOFAW unsure]:
File Name: [naming convention: SPECIESCODE_YEAR_MM-DD_FACILITY ABBREVIATION]

Observer Name:	
Report Prepared by:	
Date of Incident:	
Date of report:	
Fatality or Injury:	
Age (Adult/Juvenile), if known:	
Sex (if known):	
Incidental or Routine Search:	
Date Last Surveyed:	
Official Search Dist. and Whether In or Out	
Time Observed (HST):	
Time Initially Reported to DOFAW (HST):	
Time Picked Up and By Who:	
Deceased Animal Sent for Necropsy (Y/N)	
General Location:	
GPS Coordinates units and datum; prefer: GCS WGS84 or NAD83 UTM Zone 4N (specify):	
Closest Turbine #, distance from and bearing:	
Closest structure and distance (non-turbine):	
Ground Cover Type and Height (cm):	
Cloud Cover (%):	
Cloud Deck (m above ground level):	
Precipitation:	
Temperature (^{O}F)	
Wind Direction&Speed for Wind Projects (m/s):	

Details:

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 [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, whether sent for necropsy]:

Additional Comments:

Include the following:
-photos up close and photo with nearest structures or turbines in the background; include a ruler or measuring device to provide scale
-map showing aerial imagery with location of found animal, search area polygon, turbine numbers, and nearby features, roads, and structures labeled where applicable

Additional Information Required for Covered Species at HCP Wind Energy Sites
-For the turbine associated with the fatality, include a figure showing rotor speed, wind-speed, and all weather variables for the time period spanning the last two search periods up to the time the fatality or injury was found.
-Moon phase
-Presence and description of grazing cattle within 1 mile of the turbines (bats only)
-Presence of any standing or flowing water within 1 mile of the turbines (including watering troughs)(bats only)

Downned Wildlife Incident Documentation and Reporting Form

SPECIES NOT LISTED OR MBTA

Facility Name:
Species Common Name:
Species Scientific Name:
Four Letter Code: [common name, e.g. HOBA for the Hawaiian Hoary Bat; contact DOFAW unsure]:
File Name: [naming convention: SPECIESCODE_YEAR_MM-DD_FACILITY ABBREVIATION]

Observer Name:	
Date of Incident:	
Species (common name):	
Age (Adult/Juvenile), if known:	
Sex (if known):	
Incidental or Routine Search:	
Time Observed (HST):	
General Location:	
GPS Coordinates; GCS WGS84 or NAD83 UTM Zone 4N) (specify):	
Closest Turbine #, distance from and bearing:	
Closest structure (*e.g.*, Turbine # or Bldg):	
Distance to Base of closest structure:	
Bearing from Base of closest structure:	
Condition of specimen:	
Action Taken:	
Temperature:	
Precipitation within the past 24 hours	
Wind Direction&Speed for Wind Projects (m/s):	

Probable Cause of Injuries and Supportive Evidence:

Additional Information:

[Photos]

APPENDIX F

AVIAN RISK OF COLLISION ANALYSIS FOR THE SOUTH AUWAHI WIND RESOURCE AREA, MAUI, HAWAII

This Appendix requires no edits for the HCP Amendment

APPENDIX G

LWSC REVIEW

New Appendix associated with HCP Amendment

Literature Review of Low Wind Speed Curtailment Effectiveness on Bat Mortality

1.0 INTRODUCTION

Tetra Tech, Inc. prepared a literature review to summarize the best available science on the effectiveness of low wind speed curtailment (LWSC) and its potential for minimizing impacts to bats. This review focused on studies that implemented experimental treatments to test the effectiveness of changing turbine cut-in speeds and other operational measures on reducing bat fatalities, or syntheses of such studies. Studies included those that compared bat fatalities under the wind turbine manufacturer's cut-in speed (typically 3.5 to 4 meters per second [m/s]) and a single LWSC treatment (e.g., Martin et al. 2017, Stantec 2015, Young et al. 2012), as well as studies that compared multiple LWSC treatments (e.g., Hein et al. 2014; Good et al. 2011, 2012; Arnett et al. 2011) or the effectiveness of other operational measures (e.g., Baerwald et al. 2009, Young et al. 2011).

2.0 SUMMARY

The following synthesizes the key findings of this review. Table 1 presents the details of the studies that were evaluated.

- Increasing cut-in speeds between 1.5 and 3.0 m/s above the manufacturer's cut-in speed has been shown to yield substantial reductions in bat fatalities, ranging from 10 to 92 percent (Table 1), with at least a 50 percent reduction in bat fatalities when turbine cut-in speed was increased by 1.5 m/s above the manufacturer's cut-in speed (Arnett et al. 2013).
- Significant additional reductions in bat fatality rates have been demonstrated when cut-in speeds are raised incrementally from 3.5 to 4.5 to 5.5 m/s (Good et al. 2012), but the results of studies evaluating the additional benefits of raising cut-in speeds above 5.0 m/s are ambiguous.
    - Good et al. (2011) demonstrated a significant additional reduction in bat fatalities at Fowler Ridge (Indiana) when cut-in speeds were raised from 5.0 to 6.5 m/s; however, Hein et al. (2014) at Pinnacle Wind (Vermont) and Arnett et al. (2011) at Casselman (Pennsylvania) found no statistically significant difference between these cut-in speeds. Hein et al. (2014) does indicate, however, that even though the results were not statistically significant the estimated mortality rate for the 6.5 m/s treatment was lower than the 5.0 m/s treatments. The researchers suggest that the lack of significant differences between treatments may have been the result of the small proportion of time (18.6 percent) wind speeds were between 5.0 and 6.5 m/s (Hein et al. 2014). Thus, the difference in results may be attributed to differences in wind regimes at each project (Arnett et al. 2013).

- Tidhar et al. (2013) documented an approximately 89 percent reduction in bat fatalities at Beech Ridge (West Virginia) when turbines were curtailed at 6.9 m/s; however, the reduction was based on a comparison to other regional facilities (Mount Storm and Mountaineer), rather than on a comparison of experimental treatments implemented at other turbines at the Beech Ridge site.
- Stantec (2015) found a significant difference in bat fatalities observed between LWSC at 6.9 m/s and operation at the manufacturer's cut-in speed of 3.5 m/s with a 92 percent reduction in bat fatalities at the Laurel Mountain Wind Energy Project. However, the study did not evaluate the incremental reduction of raising the cut-in speed to 5.0 m/s compared to 6.9 m/s.

- Some studies have shown that equally beneficial reductions in bat fatalities may be achieved by feathering blades (pitched 90° and parallel to the wind) or slowing rotor speed up to the turbine manufacturer's cut-in speed (low-speed idling approach) without LWSC (Baerwald et al. 2009; Young et al. 2011, 2012; Good et al. 2017). While there may be additional benefits to bats associated with progressively higher levels of LWSC, the effectiveness of LWSC is dependent on project-specific characteristics such as wind regime, bat species at risk, surrounding land uses, and other factors (Arnett et al. 2013). This uncertainty is reflected in the incorporation of LWSC in HCPs for wind projects both in Hawai'i and on the U.S. mainland, where 5.0 m/s is a typical baseline cut-in speed for projects with potential impacts to listed bats.
- Identifying when bat collision risk could be high based on environmental parameters could optimize the timing of LWSC implementation and minimize power loss (i.e., smart curtailment; Good et al. 2011; Weller and Baldwin 2012; Arnett et al. 2016; Martin et al. 2017). Parameters such as wind speed, ambient temperature, season, and time of day as well as levels of bat activity may be considered for defining a set of operational rules for dictating when turbines are curtailed (Good et al. 2011, Arnett and May 2016, Arnett et al. 2016, EPRI 2017).
    - Fatalities appear to increase as ambient temperature rises, at least in North America and Europe, and with decreasing relative humidity. These studies suggest that fatalities may be correlated with periods of high insect activity, which generally is most likely to occur under warm and dry conditions (Arnett et al. 2016).
    - Martin et al. (2017) incorporated temperature as part of the experimental treatment, curtailing treatment turbines only at temperatures above 9.5°C and wind speeds above 6.0 m/s, and found that these parameters had a significant effect on reducing bat fatalities.
    - Baerwald and Barclay (2011) reported that species-specific fatalities were affected by greater moon illumination. They also observed that falling barometric pressure and

the number of deaths were correlated and that whereas fatalities of silver-haired bats increased with increased activity of this species, moon illumination, and south-easterly winds, hoary bat mortality increased most significantly with falling barometric pressure. Interestingly, neither hoary bat activity nor fatality was influenced by any measured variables other than falling barometric pressure. This could result from decreasing barometric pressure that triggers insect flight activity and therefore may motivate foraging efforts among bats by indicating a potential increase in food availability (Arnett et al. 2016).

- The available studies do not provide sufficient detail to discern patterns or differences in effectiveness of LWSC between bat species. This is typically because the number of bat fatalities found is too low to provide a meaningful comparison of operational mitigation by species (Martin et al. 2017), or the particular study designs are not set up to do so.
- Regarding the role that turbine model plays in LWSC, Good and Adachi (2014) reported that the effectiveness of LWSC cut-in speed may also depend on the deceleration and acceleration profile of the specific turbine model. That is, the behavior of the turbine prior to reaching cut-in speed. Good et al. (2017) reported fatality rates at the Fowler Ridge Wind Farm were highest in association with Siemens turbines, followed by Clipper, Vestas, and GE under a 5.0 m/s LWSC regime. Although this report did not speak to specific turbine differences responsible for this trend, an earlier report, Good et al. (2012) noted that turbine models at Fowler Ridge with the most fatalities spun more and at greater speeds below the cut-in speed than the other turbine models, resulting in less actual down time.

Table 1. Comparison of Available Research Studies on the Effectiveness of Changing LWSC Cut-in Speeds

Study Location	Study Year	Number of Turbines in Study	Turbine Type	Normal Operation Cut-in Speed (Control) m/s	LWSC Treatment m/s	Percent Reduction in Bat Fatalities	Study Summary	Reference
Laurel Mountain Wind Energy Project WV	2014	24	GE XLE 1.6 MW, 80-m hub height, 82.5-m rotor diameter	3.5	6.9	92	Significant difference in bat fatalities observed between LWSC at 6.9 m/s and operation at the manufacturer's cut-in speed of 3.5 m/s. LWSC was implemented from sunset to sunrise, between April 1 and November 15. Bat fatalities – eastern red bats (*Lasiurus borealis*), silver-haired bats (*Lasionycteris noctivagans*), hoary bats (*Lasiurus cinereus*), and big brown bats (*Eptesicus fuscus*).	Stantec 2015
Pinnacle Wind, WV	2013	12	Mitsubishi 2.4 MW, 80-m hub height, 95-m rotor diameter	3.0	5.0 6.5	54.4 76.2	Bat fatality rates were not significantly different between LWSC cut-in speeds of 5.0 and 6.5 m/s; however, both treatment cut-in speeds had significantly lower fatalities than the manufacturer's cut-in speed of 3.0 m/s. Turbines were fully feathered below the LWSC cut-in speeds. LWSC was implemented from sunset to sunrise, 15 July and 30 September. Bat fatalities – Eastern red bats, hoary bats, silver-haired bats, tri-colored bats (*Perimyotis subflavus*), and big brown bats.	Hein et al. 2014
Sheffield Wind Facility, VT	2012/13	16	Clipper 2.5 MW, 80-m hub height, 93-m rotor diameter	4.0	6.0	62	Cut-in speed at treatment turbines was raised from 4.0 to 6.0 m/s whenever nightly wind speeds were < 6.0 m/s and temperatures were > 9.5°C, 3 June to 30 September to capture spring and fall migration. Significant reduction in fatalities at 6.0 m/s as compared to 4 m/s cut-in speeds. Bat fatalities – Hoary bat, eastern red bats, silver-haired bats.	Martin et al. 2017

Study Location	Study Year	Number of Turbines in Study	Turbine Type	Normal Operation Cut-in Speed (Control) m/s	LWSC Treatment m/s	Percent Reduction in Bat Fatalities	Study Summary	Reference
Beech Ridge, WV	2012	67	GE SLE 1.5 MW, 80-m hub height, 70-m rotor diameter	Regional Comparison	6.9	73	Compared fatalities at the project, with implementation of LWSC at 6.9 m/s, to average fatality rates at other wind farms in the region (Mount Storm and Mountaineer); fatalities at the project were significantly lower than regional averages. LWSC was implemented one-half hour before sunset to one-quarter hour after sunrise, 1 April to 15 November. Bat fatalities – Eastern red bat, hoary bat, silver-haired bat, tricolored bat.	Tidhar et al. 2013
Fowler Ridge, IN	2011	126	GE SLE 1.5 MW, 80-m hub height, 77-m rotor diameter; Vestas V82 1.65 MW, 80-m hub height, 82-m rotor diameter; Clipper C96 2.5 MW, 80-m hub height, 96-m rotor diameter	(NO LWSC)	3.5 4.5 5.5	36.5 56.7 73.3	Bat fatality rates were measured under three different cut-in speed "treatments" (with blades feathered) and two sets of "control" turbines with no cut-in speed adjustment. Reductions in bat fatalities under each treatment were significantly different from each other and from the control turbines. LWSC implemented 1 April to 15 May and 15 July to 29 October. Bat fatalities – Eastern red bat, hoary bat, silver-haired bat, big brown bat, evening bat (*Nicticeius humeralis*),tri-colored bat, Seminole bat (*Lasiurus seminolus*), little brown bat (*Myotis lucifugus*).	Good et al. 2012
Mount Storm, WV	2011	24	Gamesa G80 2.0 MW, 78-m hub height, 80-m rotor diameter	4.0 (free-wheel)	4.0 (feathered)	10	Study evaluated the effect of feathering only, without increasing cut-in speed. Implemented 16 July to 15 October. No significant difference in fatalities was found between control turbines and feathered turbines. Bat fatalities – Hoary bat, eastern red bat, silver-haired bat, tricolored bat, big brown bat.	Young et al. 2012
	2010	27	GE SLE 1.5 MW, 80-m hub	3.5	5.0	50	Reductions in bat fatality rates under both LWSC cut-in speed treatments were	

Study Location	Study Year	Number of Turbines in Study	Turbine Type	Normal Operation Cut-in Speed (Control) m/s	LWSC Treatment m/s	Percent Reduction in Bat Fatalities	Study Summary	Reference
Fowler Ridge, IN			height, 77-m rotor diameter; Vestas V82 1.65 MW, 80-m hub height, 82-m rotor diameter; Clipper C96 2.5 MW, 80-m hub height, 96-m rotor diameter		6.5	78	significantly different from each other and from the control turbines. LWSC implemented 1 August to 15 October. Bat fatalities – Eastern red bat, hoary bat, silver-haired bat, big brown bat, tri-colored bat, Indiana bat (*Myotis sodalis*), little brown bat.	Good et al. 2011
Mount Storm, WV	2010	24	Gamesa G80 2.0 MW, 78-m hub height, 80-m rotor diameter	4.0 (free-wheel)	4.0 (feathered)	47/22	Treatments were compared for first half vs. second half of the night, 15 July to 15 October. Feathered turbines (treatment) had significantly fewer mortalities than unfeathered, free-wheeling (control) turbines. Bat fatalities were significantly lower for feathered turbines during the first half of the night vs the second half. The study was conducted mid-July to mid-October. Bat fatalities – Eastern red bat, hoary bat, silver-haired bat, big brown bat, tri-colored bat, little brown bat, Seminole bat.	Young et al. 2011
Casselman, PA	2008-09	12	GE SLE 1.5 MW, 80-m hub height, 77-m rotor diameter	3.5	5.0 6.5	2008 – 82 2009 – 72	No significant difference in fatality rates between 5m/s and 6.5 m/s LWSC treatments; however, both cut-in speeds had significantly lower fatalities than turbines operating at the manufacturer's cut-in speed of 3.5 m/s. LWSC implemented in experimental units 27 July to 9 October 2008, and 26 July to 8 October 2009. Bat fatality species not identified.	Arnett et al. 2011
Alberta, Canada	2008	21	Vestas V80 1.8 MW, 65-m hub height, 80-m rotor diameter	4.0 m/s	Blade feathering, low speed idle strategy	60	Blades were angled 45^0 to reduce rotor speed at low wind speeds which resulted in a significant reduction in bat fatalities by 60 percent. Blade angling implemented sunset to sunrise, 15 July to 30 September.	Baerwald et al. 2009

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APPENDIX H

EVIDENCE OF ABSENCE ANALYSIS

New Appendix associated with HCP Amendment

1.0 INTRODUCTION

This appendix describes the approach Auwahi Wind, LLC (Auwahi Wind) used for estimating total Project-related take of the Hawaiian hoary bat (*Lasiurus cinereus semotus*) at the Auwahi Wind Project (Project) over the remaining years of the term of the Incidental Take Permit (ITP)/Incidental Take License (ITL) for this Habitat Conservation Plan (HCP) Amendment. The appendix is provided to give additional detail on the estimation process. The current standard for fatality estimation when the annual level of take is low (i.e., less than seven observed fatalities per year per Dan Dalthorp, personal communication., March 2, 2018) is to use the Evidence of Absence software (EoA; Dalthorp et al. 2017). EoA is a statistical software package that considers the observed fatalities as well as other study parameters to account for fatalities that may have been missed during regular searches. A summary of the methods used to calculate the direct take using EoA is provided. The information provided here assumes the reader is familiar with Evidence of Absence and has a familiarity with statistics.

The estimate of total Project-related take includes the take currently authorized under the approved HCP and the additional take estimated to occur during the remaining years of the Project's ITP/ITL term and requested under the HCP Amendment. Hawaiian hoary bat ecology and potential Project-related sources of take are described in detail in Sections 3.8.1 and 5.1 of the HCP Amendment, respectively, and are not discussed further.

2.0 DIRECT TAKE

The EoA software package was used to model potential fatality levels (direct take only) over the 20-year operating period of the ITP/ITL based on Project-specific fatality data and to estimate a requested take limit. For estimating direct take, the software produces a probability function that estimates the likelihood that estimated mortality is equal to actual mortality. The probability function is illustrated in Figure 1.

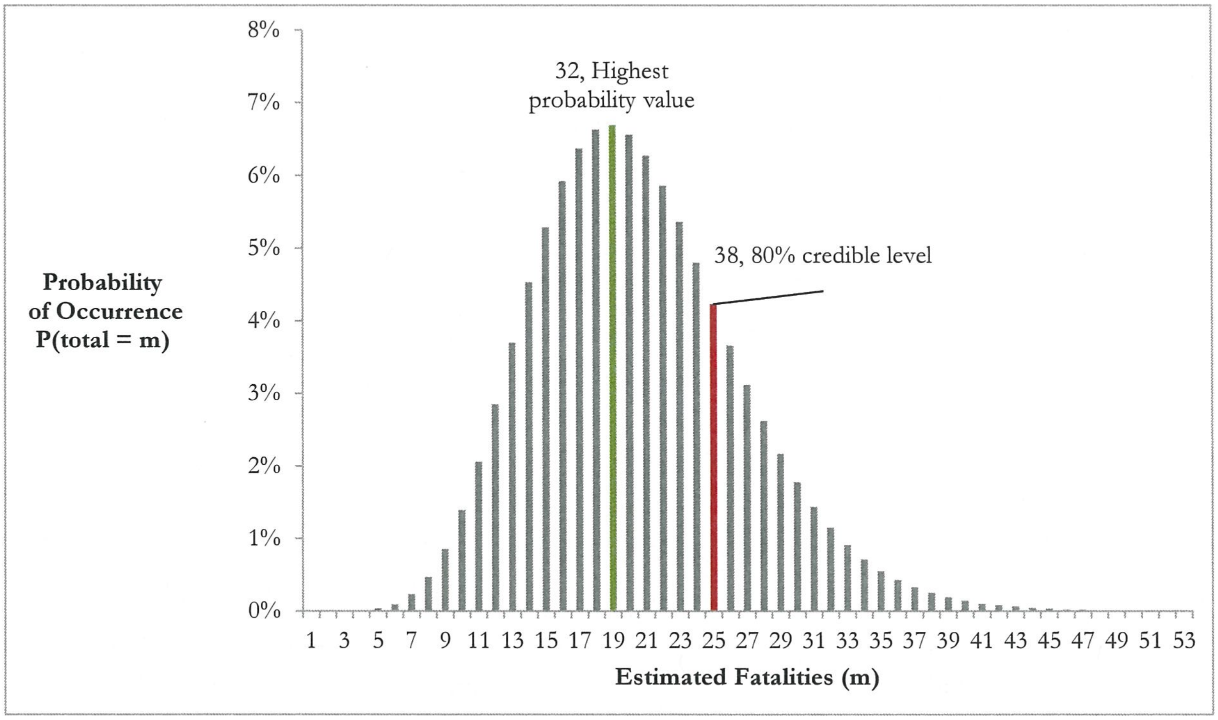

Figure 1. EoA Estimated Mortality Probability Function: Predicted vs Actual Mortality

4.2.1 Estimate *M*

Mortality estimates are defined for a specific credibility level, $1-\alpha$, which is entered by the user. The value of $1-\alpha$ can be interpreted as approximately the probability that the true number of fatalities (M) is less than or equal to the estimated number of fatalities (M^*). An M^* based on a credibility level of $1-\alpha=0.5$ is the most accurate (in the sense that odds are about 50-50 that $M \leq M^*$), while higher credibility levels yield larger M^* and greater assurance that $M \leq M^*$.

Figure 2. Excerpt from the EOA user's manual page 31 (Dalthorp 2017).

The user's manual for EoA recommends a credible level of 50 percent as being the most accurate in terms of take being equally likely to exceed or fall below the predicted value (Figure 2), and that the use of a higher credibility level will lead to a larger take estimate with greater assurance that actual take will be less than estimated take. The credibility level represents the likelihood that the predicted mortality exceeds the actual mortality. The alpha value is related to the credible level by the function:

$$Credible\ level = 100\% * (1 - alpha)$$

This means that an alpha value of 0.2 is equal to a credible level of 80 percent.

The U.S. Fish and Wildlife Service (USFWS) and Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) have required that permittees use the 80 percent credibility level to assess compliance with an ITP/ITL. Therefore, the estimate of total Project-related take for the HCP Amendment also uses this value. This results in higher take estimates with greater certainty that actual mortality is less than estimated mortality. The 80 percent credible level means there is an 80 percent probability that actual mortality is equal to or less than the predicted mortality. The 80 percent credible level includes all values below, providing confidence that actual take would be less than the estimated take.[17] All subsequent predictions and estimations are therefore provided at the 80 percent credible level.

Data from post-construction monitoring conducted at the Project and planned monitoring efforts for future years were incorporated into the EoA analysis. The Project-specific data (Table 5-1 of the HCP Amendment) was input into the multi-year module of the EoA to evaluate the probability of occurrence for various potential future take scenarios. The model runs 10,000 simulations from the observed data and the output provides the user with the levels of confidence that estimates of take at a user-defined credibility level would not be exceeded over the permit term. Results are a function of the user-defined credibility level, observed fatalities, and past and projected future monitoring efforts. Auwahi Wind selected the 75th percentile value of the probability distribution to provide confidence that the assessed level of take would not be exceeded during the permit term. In other words, Auwahi Wind is 75 percent certain that when fatalities are estimated at the agency-recommended 80 percent upper credible limit, the estimate will not exceed the requested permitted take limit over the permit term based on current data.

Bat fatalities and bias correction data recorded during post-construction mortality monitoring surveys conducted during 5 years of Project operation were assumed to be representative of baseline fatality trends expected over the ITP/ITL permit term and provided input values that were incorporated into the model. Inputs include the number of observed fatalities, searcher efficiency and carcass persistence data, and the proportion of the carcass distribution searched to get the overall detection probability. For the remaining years of operation within the permit term (2018–2032), model input parameters were estimated based on data collected under the current monitoring protocol (assumptions described further below). Input parameters are shown in Table 5-1 of the HCP Amendment. These model inputs created a 20-year dataset that was analyzed using the EoA software to model the predicted credible maximum number of fatalities (based on the selected 80 percent credibility level) that could be taken over the life of the Project.

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[1] In the EoA output in figure 3a, the line above item 1 provides an illustration of the difference between actual mortality and estimated mortality within EoA. The mean take estimate was 120, or 7 less than the 127 direct take estimate at the 80% credible level for all scenarios among projects with triggering (i.e. EoA indicates take exceeded the permitted amount).

Several assumptions were made to develop input parameters for the remaining years of the ITP/ITL permit term, and are described in the bullets below.

- The level of monitoring will continue at the level initiated in Jan 2018.
- The detection probability (g) will remain consistent throughout the Project's ITP/ITL permit term. Model input values for these parameters were based on the 2018 monitoring, as current conditions are assumed to best represent ongoing monitoring.
- The Project assumes minimization measures described in the HCP Amendment will be effective at reducing the take rate by 30 percent to 70 percent, for all future years. This is incorporated into the estimate of future take as a rho value. (A rho value represents the relative risk at the site. A rho of 0.5 would represent a risk of half and could be thought of as reducing the number of turbines by half or an equivalent method of reducing risk. Rho values can also be used to represent a portion of the year.) Because the effectiveness of minimization is uncertain, the values of 30 percent reduction (rho=0.7), 50 percent reduction (rho=0.5), and 70 percent reduction (rho=0.3) were applied to all future years to project future take.
- Based on the model inputs and assumptions described above, the EoA software analysis estimates the current direct take is 38 (Figure 3b, Item 3). These data are incorporated into the projection of future take, for which there are three possible scenarios as described in the assumptions. The maximum total direct take estimated is 129 (Figure 3a, Item 2) which is selected from the 75th quantile of the projections of future take where minimization measures result in a 30 percent reduction in take. Given this direct take estimate, EoA predicts a 79 percent probability that the direct take estimate will not exceed the 129 over the remaining years of operation (Figure 3a, Item 1).

```
=================================================================================
Summary statistics from posterior predictive distributions for 10000 simulated projects
-------------------------------------
Estimated annual baseline fatality rate (lambda for rho = 1): mean = 6.81, 95% CI = [3.9, 10.5]

Projected fatalities and fatality estimates...
p(M > Tau within 21 years) = 0.1218  [exceedance]
p(M* > Tau within 21 years) = 0.2115  [triggering]
M* based on credibility level 1 - alpha = 0.8

Among projects with triggering (21.03%), mean(M) = 120.07 at time of triggering, with median = 119 and IQR = [113, 126]
Among projects with no triggering (78.97%), mean(M) = 97.54 at end of 21 years, with median = 98 and IQR = [87, 109]

Years of operations without triggering:
 Mean = 20.62, with median =  21 and IQR = [21, 21]

----------------------------------------
Summary statistics for projection years
```

Yr	Mean M	M*	quantiles of M 0.05	0.10	0.25	0.50	0.75	0.90	0.95	quantiles of M* 0.05	0.10	0.25	0.50	0.75	0.90	0.95
1	38.4	43.5	28	30	34	38	43	47	50	37	39	39	44	46	48	50
2	43.1	48.3	32	34	38	43	48	53	56	41	41	45	47	51	55	59
3	47.8	53.0	36	38	42	47	53	58	62	42	44	48	52	58	62	66
4	52.6	57.7	39	42	46	52	58	64	68	45	47	51	57	63	69	73
5	57.4	63.3	42	45	50	57	64	70	75	49	51	55	63	69	76	82
6	62.2	68.1	46	49	54	62	69	76	81	50	54	60	68	76	84	89
7	66.9	72.9	49	52	58	66	74	82	87	54	58	63	71	81	90	96
8	71.6	77.8	52	56	63	71	80	89	94	57	61	67	76	86	97	103
9	76.3	82.7	55	59	66	75	85	95	101	59	64	72	82	93	103	110
10	81.1	87.6	58	63	70	80	91	101	108	62	68	75	87	98	109	117
11	85.8	92.5	61	66	74	85	96	107	114	66	69	79	90	103	116	124
12	90.6	97.4	64	69	78	89	102	114	121	69	73	84	95	110	123	131
13	95.3	102.4	67	73	82	94	107	120	128	71	76	87	101	115	130	139
14	100.1	107.2	70	76	86	99	113	126	134	74	80	91	106	121	137	146
15	104.8	112.1	74	79	90	103	118	133	141	78	83	96	111	127	142	153

Notes:

- The quantiles shown are derived from bootstrapped samples and subject to minor fluctuation (±2 is common) over multiple runs. The value of 129 estimated direct take represents the highest expected value for the 75th quantile.
- The division of 2017 into 2 periods adds a 'year' to the calculations, so projections account for 21 years instead of 20 years.

Figure 3a. Output of the EoA Used for Prediction of Future Years Given the 30% Reduction in Take Rate Scenario (Page 1 of 2)

```
Governing parameters: Tau = 129, alpha = 0.2

Data for 6 years of monitoring:
            yr     x     g     glwr    gupr   rho  M*
           2013    1 0.2817 0.2120 0.3513  1    8
           2014    4 0.5476 0.4436 0.6515  1.08  16
           2015    1 0.4508 0.3761 0.5256  0.917  18
           2016    7 0.5490 0.4618 0.6363  1   34
           2017    0 0.6683 0.5925 0.7441  0.17  33
          2017b    3 0.5797 0.4787 0.6807  0.83  38

Parameters for future monitoring and operations:
  Number of years:  15
  g = 0.6, 95% CI  [0.5, 0.65]
  Relative weight (rho): 0.7
*****************************************************************************************
Summary statistics for mortality estimates through 6 years
-------------------------------------
Results
Totals through 6 years
         3
M* = 38 for 1 - alpha = 0.8, i.e., P(M <= 38) >= 80%
Estimated overall detection probability: g = 0.486, 95% CI = [0.449, 0.524]
    Ba = 327.85, Bb = 346.27
Estimated baseline fatality rate (for rho = 1): lambda = 6.805, 95% CI = [3.9, 10.5]

Cumulative Mortality Estimates
Year          M*    median    95% CI    mean(lambda) 95% CI
2013           8      4       [1, 13]   5.4510    [0.3849,   17.28]
2014          16     12       [6, 22]   13.2200    [ 4.525,   26.68]
2015          18     14       [8, 25]   15.2200    [ 5.815,   29.19]
2016          34     28       [19, 42]   29.4900    [ 15.79,   47.55]
2017          33     28       [19, 41]   28.9500    [ 15.51,   46.63]
2017b         38     33       [23, 46]   34.0100    [ 19.51,   52.59]

Annual Mortality Estimates
Year          M*    median    95% CI    mean(lambda) 95% CI
2013           8      4       [1, 13]   5.4510    [0.3849,   17.28]
2014          10      7       [4, 13]   8.3330    [ 2.453,   17.95]
2015           4      2       [1, 7]   3.3620    [0.2398,   10.56]
2016          16     13       [8, 21]   13.7900    [ 5.661,   25.71]
2017           0      0       [0, 1]   0.7517    [0.0007532,   3.783]
2017b          7      5       [3, 10]   6.1080    [ 1.454,   14.17]


Test of assumed relative weights (rho) and potential bias              Fitted rho
Assumed rho       95% CI
      1      [0.060, 1.815]
   1.08      [0.378, 2.150]
  0.917      [0.042, 1.282]
      1      [0.825, 2.967]
   0.17      [0.001, 0.549]
   0.83      [0.220, 1.683]

p = 0.32609 for likelihood ratio test of H0: assumed rho = true rho
Quick test of relative bias: 1.036

===============================================================================
Input
Year (or period) rel_wt  X     Ba      Bb   ghat      95% CI
2013              1.000  1   46.7   119.1 0.282 [0.216, 0.352]
2014              1.080  4  49.68   41.05 0.548 [0.445, 0.648]
2015              0.917  1  79.43   96.75 0.451 [0.378, 0.525]
2016              1.000  7   70.9   58.24 0.549 [0.463, 0.634]
2017              0.170  0  102.4   50.82 0.668 [0.592, 0.740]
2017b             0.830  3  54.79   39.72 0.580 [0.479, 0.677]
```

Figure 3b. Output of the EoA Used for Prediction of Future Years Given the 30% Reduction in Take Rate Scenario (Page 2 of 2)

3.0 INDIRECT TAKE

After estimation of direct take, indirect take was calculated based on the calculations outlined in the HCP Amendment Section 5.1.3 using the guidance provided by the USFWS. The direct take of an adult female bat during the time when young are dependent on her may result in the indirect loss or take of dependent offspring. Variables used to predict the magnitude of this indirect take are based on parameters recommended in USFWS and DOFAW guidance (USFWS 2016):

- A conservative estimate of direct take (Section 5.1.1);
- The proportion of take assumed to be adult females (only female bats care for young);
- The proportion of fatalities occurring during the period when young bats are dependent;
- The probability that the loss of a reproductively active female results in the loss of her offspring;
- The average reproductive success rate; and
- The proportion of young that survive to reproductive age.

The rationale and values used to predict indirect take are outlined in Table 5-2 of the HCP Amendment, and result in an indirect take prediction of 11 adult-equivalent bats during 20 years of operation. Because current mitigation frameworks only provide guidance relative to adult bats, indirect take was adjusted to adult equivalents by multiplying the predicted number of indirectly-taken juveniles by the probability those juveniles would survive to become adults (Table 5-2, Rows 2-5).

4.0 TOTAL ADJUSTED TAKE

The sum of direct and indirect take estimates was used for the total take estimate shown in Table 1. Applying this approach to the Project HCP Amendment and Project data produces a requested take limit of 140 bats (including estimates of both indirect and direct take) through 2032. Calculations for the 50 and 70 percent reductions follow the guidance used above, and using a rho value as indicated in section 2 for future years.

Table 1. Tier Structure

Tier	Cumulative Direct take	Cumulative Indirect take[1]	Take within Tier[2]	Potential Scenario
1-3	18	3	21	Authorized in approved HCP
4	79	7	22 – 81[3]	Reduction in take rate of 70% through additional minimization measures.
5	102	9	82 – 115[3]	Reduction in take rate of 50% through additional minimization measures.

Tier	Cumulative Direct take	Cumulative Indirect take[1]	Take within Tier[2]	Potential Scenario
6	129	11	116 – 140	Reduction in take rate of 30% through additional minimization measures.

1. Estimation of indirect take is based on USFWS guidance for calculating indirect take. Actual estimation of future indirect take will vary based on the timing and gender of observed fatalities.

2. Take occurring within tier and assessing compliance with the authorized take limit is based on the 80% credible level estimate of take using EoA (or then current best available science) plus indirect take.

3. Take within Tiers 4 and 5 was adjusted to account for agency guidance to have a minimum of 25% of take within any tier, no more than 50% of take occurring within any tier, as well as having the last tier account for the smallest amount of take.

5.0 REFERENCES

Dalthorp, D. and M. Huso. 2017 (in review). Evidence of absence software user guide v.2: U.S. Geological Survey Data Series 881.

Dalthorp, D. Personal communication. March 2, 2018.

USFWS. 2016. Wildlife agency guidance for calculation of Hawaiian hoary bat indirect take. USFWS Pacific Islands Field Office. Honolulu, HI. October 2016.

APPENDIX I

AMENDMENT TO FUNDING MATRIX

New Appendix associated with HCP Amendment

Table 1. Tier 4 Funding by Action

Action	Cost per unit	Units	Source	Quantity	Total
Conservation Easement	100,000	Total	HILT	1	100,000
Water trough modification	10,000	Per trough	Eco Products	15	150,000
Koa Planting	1,965	Per acre	Forestry Solutions	384	754,560
Fencing	5	Per foot	'Ulupalakua Ranch	195,000	975,000
Pond installation	92,000	Per Pond	Goodfellow Brothers	2	180,000
Person Hours (maintenance, monitoring)	25	Per hour	Tier 1 mitigation costs	87,36	218,400
Acoustic monitoring	1,500	Per detector per year	Tetra Tech	333	499,500
Insect monitoring	3,000	Per sampling	Tier 1 mitigation costs	18	54,000
Thermal videography	10,000	Per camera per month	Estimate	3	30,000
				Sub-Total	**2,961,460**
Adaptive Management					
Koa Planting	1,965	Per acre	Forestry Solutions	197.5	463,740
Pond installation	92,000	Per Pond	Goodfellow Brothers	4	368,000
Person Hours (maintenance, monitoring)	25	Per hour	Tier 1 mitigation costs	1,150	28,750
				Sub-Total	**860,490**
				Combined Sub-Totals	**$3,821,950**
				DOFAW Contingency	**$191,097**
				Total	**$4,013,047**

Table 2. Funding Assurances

Tier	Category[1/]	One-time Cost[2/]	Cost per year	Years of Effort	Total	Notes
Tier 4	Protection, and restoration	$3,821,950	---	---	$3,821,950	Planning for mitigation initiated; Parcel selection criteria identified in Section 6.2.4. Letter of credit to be provided within 60 days of issuance ITP/ITL and execution of amendment to Implementation Agreement, if needed.
Tier 4	DOFAW Contingency	$191,097			$191,097	Estimated at 5 percent of mitigation. Contingency funding/adaptive management covers any outstanding mitigation obligations should Auwahi Wind be unable to fulfill obligations under the current tier or if adaptive management requires additional funds.
Tier 4 total		**$4,013,047**			**$4,013,047**	
Future Tiers						
Tier 5[2]	Additional mitigation	$2,165,771	---	---	$2,165,771	Dollars estimated in 2018. The actual cost of the mitigation will vary based on, inflation and the timing of mitigation, and the mitigation actions selected. The cost is outlined relative to the number in the bats in the tier proportional to the mitigation costs of Tier 4. Timing to be determined in consultation with and approval by DOFAW and USFWS; funding assurances to be provided within 90 days of triggering planning for this tier.
Tier 5[2]	DOFAW Contingency	$108,288			$108,288	Estimated at 5 percent of mitigation
Total Tier 5		**$2,274,059**			**$2,274,059**	
Tier 6[2]	Additional mitigation	$1,592,479	---	---	$1,592,479	Dollars estimated in 2018. The actual cost of the mitigation will vary based on, inflation and the timing of mitigation, and the mitigation actions selected. The cost is outlined relative to the number in the bats in the tier proportional to the mitigation costs of Tier 4. Timing to be determined in consultation with and approval by DOFAW and USFWS; funding assurances to be provided within 90 days of triggering planning for this tier.
Tier 6[2]	DOFAW Contingency	$79,623			$79,623	Estimated at 5 percent of mitigation
Total Tier 6		**$1,672,102**			**$1,672,102**	

1. Other mitigation measures, and thus a revised mitigation budget would be agreed upon and consistent with USFWS/DOFAW guidance at the time each specific mitigation tier is considered.

2. Prices estimated in 2018 dollar equivalents, prices to be adjusted for increase in costs described in Section 9.4.

Table 3. Operational Costs

Category	Annual costs	Notes
Ongoing Compliance	$100,000	Wildlife Education and Incidental Reporting Program, Post-Construction Monitoring and Reporting and Mitigation Monitoring.
DLNR Compliance	$10,000	Estimated cost of DOFAW compliance monitoring conducted only if needed.
Total Operational Costs	**$110,000**	

APPENDIX J

DLNR PROPOSALS FOR KAMEHAMENUI

New Appendix associated with HCP Amendment

Forest Legacy Project

Kamehamenui Forest Project

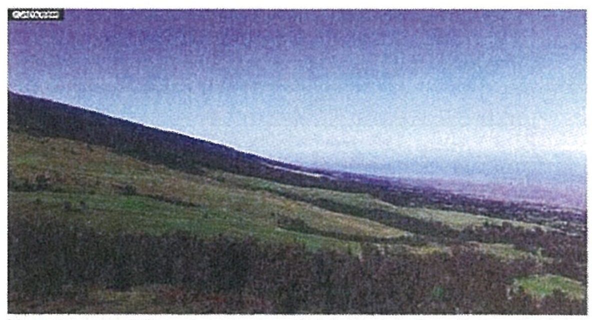
Maui County, Hawaii

FUNDING HISTORY

FY 2018 Forest Legacy Program Funding	$5,000,000
FY 2018 Non-Federal Cost Share	$3,000,000
FY 2018 Project Costs	$8,000,000
FY 2018 Project Acres	3,276
Forest Legacy Funding To Date	$0
Total Project Costs	$8,000,000
Total Project Acres	3,276

Tract Name	Size (ac)	Tract Cost	FLP Funding	Non-Fed Cost Share	Status
Kamehamenui	3,276	$8,000,000	$5,000,000	$3,000,000	Proposed 2018

GENERAL DESCRIPTION


Kamehamenui Forest project and Haleakala's forested watershed. (Photo by Sakamoto Properties)

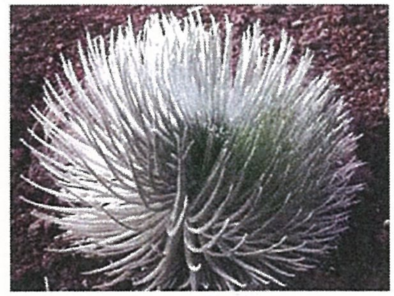
Kamehamenui Forest (KF), on the north slopes of Haleakala Mountain, is the site of the historic Von Tempsky's Erehwon Ranch ("nowhere" backwards) founded in 1875 and immortalized in bestselling novels about the family's adventures. Now listed for sale, the State with the adjacent Haleakala National Park aims to protect the property's tropical mesic forest and subalpine ecosystems through fee purchase. The upper elevations (>8000') are designated federal critical habitat for 10 rare plant and bird species and will be vital for species migration due to climate change. The lower elevations are well suited for reforestation with ecologically and economically valuable species such as koa and sandalwood, which command the highest prices of all Hawaii's forest products and can be managed under sustainable selective harvesting prescriptions. Nestled between state forest reserve and federal land, adding to the landscape of private conservation projects dotting this majestic Maui viewshed, KF is strategically critical for the Watershed Partnerships. Moreover, the area is ecologically prime for forest management, adding ecosystem benefits of carbon sequestration, endangered species enhancement, and most importantly increased water supply.

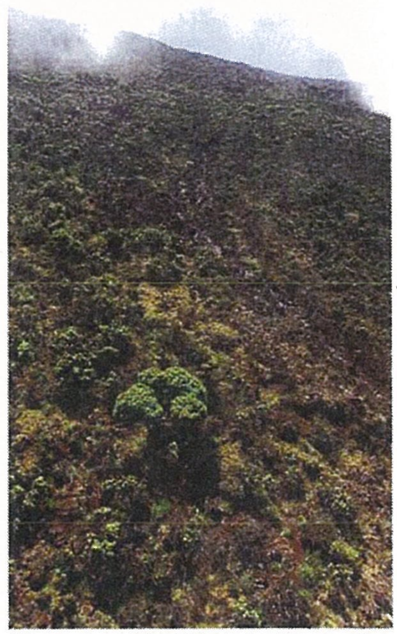
PROJECT FEATURES

Important

- WATER: Groundwater supplies replenished by watershed forests are the primary source of freshwater. The importance of Maui's forests was documented in the 1800s when the entire district went dry due to deforestation of SE Haleakala. This prompted landscape reforestation on state and private land.
- Central Maui development has put significant strain on domestic water reaching crisis level in 2001, such that a community successfully petitioned the state to intervene assuming control over an aquifer that was severely overdrawn; reforestation is necessary to increase water supply in islands.

- The disparity between population growth and the supply of freshwater on Maui resulted in city officials passing a water bill in 2007 that requires all developers to identify long-term water sources. The county significantly increased investment in forest watershed management and preservation.
- The county estimates the demand for water on the NW slopes of Haleakala and Wailuku will increase by 46.5% by 2030. KF is essential for recharging the Makawao aquifer of Central Maui, which has been identified as a potential source to meet this demand.
- UNIQUE: Of the 8 main Hawaiian Islands only two reach elevations high enough to support subalpine communities that occur between 6000-9000'. On Maui, this unique habitat blankets Haleakala just below the summit. The upper elevations of KF are covered by this intact native subalpine ecosystem.
- ENDANGERED: Federal endangered Hawaiian nene forages in subalpine habitats on KF. Compared to other geese, nene are more terrestrial with longer legs and less webbing on their feet, likely for walking on lava flows. The nene was successfully saved from the edge of extinction by captive breeding.
- KF has 1175 acres of federal designated critical habitat for 8 plant species. Of these, the Haleakala silversword was once so abundant that in 1873 travel writer Isabella Bird described how their "frosted silver gleam" made the "hillside look like winter or moonlight;" by 1930s, only 4000 were left.
- KF contains 763 acres of critical habitat for 2 species of forest birds, the Maui parrotbill and the crested honeycreeper. A newly designated wildlife sanctuary for the Hawaiian petrel, protected under the federal Endangered Species Act and the Migratory Bird Treaty Act, also abuts the property.
- Experts agree it is highly likely there are Hawaiian petrels at KF. Nesting of this unique petrel is restricted to remote montane habitats. They require dark corridors as they transit to and from the ocean. Artificial lighting causes disorientation, collision, and predation when birds are grounded.
- The federal endangered Hawaiian hoary bat, endangered forest birds and native insects are known to migrate to newly restored forest areas. Forest restoration and management at KF will expand habitat and serve as a mitigation site for the hoary bat, which are threatened by expanding windfarms.





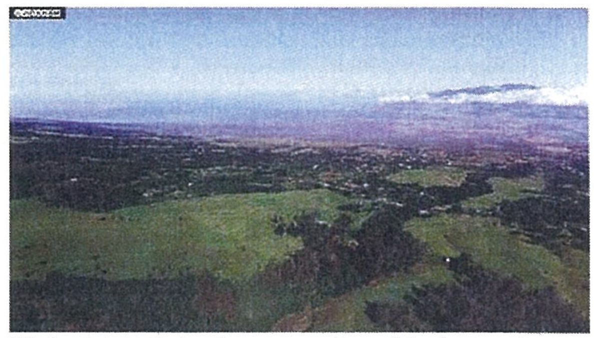
Silvery glow of the Haleakala silversword and KF subalpine ecosystem. (Photo by DOFAW)

- UNIQUE: The koa, ohia and sandalwood dominated forest that once fully circled Haleakala is crucial habitat for Maui's endangered plants and birds. Partners are actively restoring this lei of forest to connect exist habitats, and KF is identified as essential for connecting this "Mauna Lei."
- TIMBER: KF has 2233 acres of prime lands ideal for native timber production due to its accessibility, adequate precipitation, deep fertile soil, gentle slopes and proximity to other forests. Koa reforestation and production are successful on neighboring state and private lands.
- Koa's highly variable color, grain, and superior tonal qualities make it Hawaii's most valuable hardwood, ranging from $20-100 per board foot. A recent venture by a reputable guitar manufacturer in the use of koa, illustrates a growing demand and need for increased supply of this resource.
- NON-TIMBER: Koa is a fast-growing nitrogen fixing tree that can reach heights of 20-30' in 5 years, sequestering 2 tons of carbon/acre/year. It is the ideal species for local carbon credit projects, creates habitat for native species and is the primary host for native hemi-parasitic sandalwood.
- The opportunity for sandalwood production is significant on KF. Sandalwood is one of the most valuable trees in the world with high quality tree valued at $10,000-50,000 per tree and over 34 different products, including production of sandalwood essential oil that markets for around $85/5mL.
- HISTORIC: The property is deeply rooted in Maui's ranching history. Locally dubbed the "old Von

Tempsky" place, the "colorful" history of the family has been described in historical accounts of Haleakala and recorded in the autobiographies and novels of bestseller author Armine Von Tempsky.

- SCENIC: The viewshed of the Von Tempsky's time of forests intersected with pastures is still found on the slopes of Haleakala that dominates the view for resident and tourists driving through the Central Maui plains (over 2.5 million Maui tourists annually). The KF parcel climbs 5000 ft of this mtn.
- KF will preserve the viewshed for numerous visitors to Haleakala National Park (1,216,772 visitors in 2015) as they drive along the summit road to the visitor center. Visitors enjoy sweeping panoramic views down the slopes of Haleakala that includes KF.
- ACCESS: KF will be open for public recreation and subsistence hunting. Hunting, an important and popular cultural activity, helps control feral pig populations that if left unchecked would disrupt watershed function.
- There are approximately 2000 hunting licenses issued on Maui annually. The acquisition of KF would represent an increase of 4.8% in the total acreage available for public access, recreation and subsistence hunting. Making "nowhere" somewhere for millions of residents and visitors of Maui.

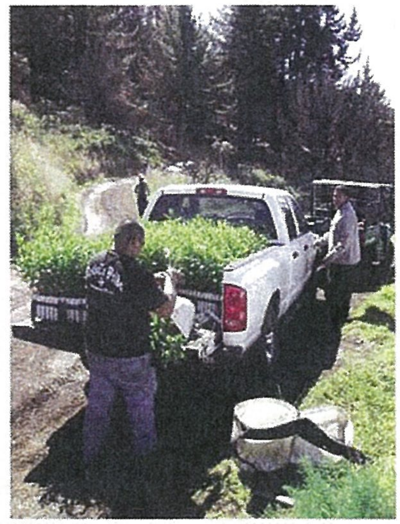
Threatened


KF showing gentle terrain, ocean and mountain views, and growing Kula community. (Photo by Sakamoto Properties)

- CIRCUMSTANCE: The owners recently finalized their divorce settlement and the parcel located in the fastest growing area of Upcountry Maui, is for sale. The property owner is supportive of a state purchase, but is still accepting offers in an effort to quickly sell the property and move on.
- In addition to the State, there are several potential buyers actively looking at this property. Potential buyers of this expansive property would need to be wealthy or, more likely, developers and development speculators. This historical property is highly at risk for development.
- LAND USE: Hawaii is in the top third of fastest growing states (density/mi2) with one of the smallest land bases. Population on Maui grew 250% between 1970 and 2006, putting pressure on agriculture and forested land that are rapidly being converted to other uses across the state.
- Often referred to as "the next Honolulu", Maui tourism and residential development has exploded in the last 3 years. Per real estate websites, from Central to Upcountry Maui there are several new real estate developments near completion, already with long waiting lists.
- DEVELOP: Heavenly Kula is off the coast and up the mountain where you will find KF in Upcountry Maui. The elevation creates a lush, cool and quiet district that is most peaceful part of the island. The best views are enjoyed here, and you don't miss the ocean because it's visible all around you.
- Two small parcels have already been subdivided off of KF and now have large attractive homes with garden plots. The remodeled Von Tempsky home (not on KF) was featured in a local magazine and is worth over $1 mil. The parcel has no legal protection against subdivision and 2/3 can be development.
- PROTECTION: The bulk (2/3) of KF is zoned Agriculture. County ordinance allows for subdivision into roughly 121 lots ranging from five to 40 acres with two dwellings allowed per lot. Intensive farming, land clearing, homes and infrastructure are allowed without approval, permit, or harvest plan.
- DEVELOP: Gentle terrain, accessibility and infrastructure in the vicinity are ideal for development interests. There are 5 new agricultural subdivisions nearby, the closest only 3 miles downhill from KF where developers are subdividing 1,860 acres into 86 home lots ranging from 5-40 acres.
- KF is located only 18 miles from Kahului that contains an international airport, community center and is the commercial and financial hub of Maui. With expansive multi-island, mountain and ocean views in every direction and a year round pleasantly cool climate, the area is prime for development.
- More than 75% of the region's workforce commutes to Kahului. There is a main highway to KF that is less than 30 minutes to drive, and a public elementary school less than a mile away. With established

communities immediately downslope, development of KF as gentleman estates is virtually certain.

Strategic



LHWRP reforestation planting project immediately adjacent to KF. (Photo by DOFAW)

- PROTECTED: The property is strategically located between state and federally protected areas. KF abuts the State Kula Forest Reserve (FR) and Haleakala National Park. Acquisition will strengthen connectivity between Kula FR (4931 acres) and a contiguous network (108,000 acres) of state, federal and private non-profit reserves that were created to conserve Maui's forest resources in perpetuity.
- INITIATIVE: At 2016 IUCN World Conservation Congress, Hawaii's Governor announced "The Sustainable Hawaii Initiative" where he committed to protecting 30% of Hawaii's priority watershed by 2030. KF expands the protected watershed on Maui and contributes to this statewide objective.
- Two Watershed Partnerships encompass the majority (150,500 acres) of Haleakala Mountain. KF was part of the Leeward Haleakala Watershed Restoration Partnership (LHWRP), but was removed due to change in ownership pursuant to the divorce settlement, leaving a significant hole in watershed management. Acquiring KF will secure its participation, which is necessary to achieve partnership goals.
- LHWRP has successfully restored large portions of their watershed that was severely impacted by decades of forest conversion. Forest management at KF is required to achieve the overarching goal of LHWRP to restore the "Mauna Lei" or the band of forest that once encompassed Haleakala. Restoration of Mauna Lei is an identified strategy of the USFWS Revised Recovery Plan for Hawaiian Forest Birds.
- The Maui parrotbill and the crested honeycreeper are reduced to a single population on the north side of Haleakala. The long term plan is to reestablish populations on the south facing slopes with subsequent reforestation westward around the mountain through KF, connecting the two populations. KF sits within this high priority reforestation area.
- PLAN: The Hawaii Forest Action Plan identified Water and Forest Health as Issue # 1 and #2 respectively. Identified threats in the plan that are mitigated by the purchase of KF include loss of forest cover, invasion by destructive weeds, urbanization, and inconsistent human activities. Additionally, KF contributes to Issue #8 Forest Products by making land available for production.
- The Pacific Island Climate Change Cooperative and the State Wildlife Action Plan (SWAP) both identified climate change as a major threat to Hawaii's forest birds. Increasing temperature will allow vectors of avian disease to invade higher elevations, reducing and in some cases eliminating available habitat. Creating corridors to facilitate distribution shifts is a priority mitigation strategy.
- Habitat protection and reforestation at KF supports the Hawaii SWAP's highest priority objective to maintain, protect, manage, and restore native species and habitats in sufficient quantity and quality to allow them to thrive. Further, in partnership with the State, the US National Park Service of Hawaii has identified KF as the #2 acquisition priority under their LWCF Islands at Risk proposal.
- The Maui Plant Extinction Prevention Program and state and federal botanist have identified KF as an ideal site for the establishment of at least 3 separate populations of critically endangered plant species (less than 50 exist in the wild) previously known to the area. KF is one of limited site available in this habitat type for the establishment of these exceedingly rare species.
- STRATEGIC: Proven examples of successful reforestation on Haleakala started in 1928 with Kula FR where they replanted 1819 acres. Subsequent forest restoration projects span the landscape at Nakula Natural Area Reserve, Kahikinui FR, Ulupalakua Ranch and Haleakala Ranch. Expertise and cooperative efforts are coordinated through the Watershed Partnerships.

Readiness

Pre-Appraisal/Market Analysis	1
Easement or Fee Conditions	0
Non-Federal Cost Share Commitment	0
Signed Purchase Agreement	0
Title Search	1
Mineral Determination	1
Stewardship Plan (or equivalent)*	1
Readiness Total Tally Score	**4**

Supporting Parties

Haleakala National Park; Trust for Public Land; The Nature Conservancy of Hawaii; Hawaiian Island Land Trust; Leeward Haleakala Restoration Partnership; East Maui Watershed Partnership; and Maui Plant Extinction Prevention Program.

For more information on the Forest Legacy Program, please contact:

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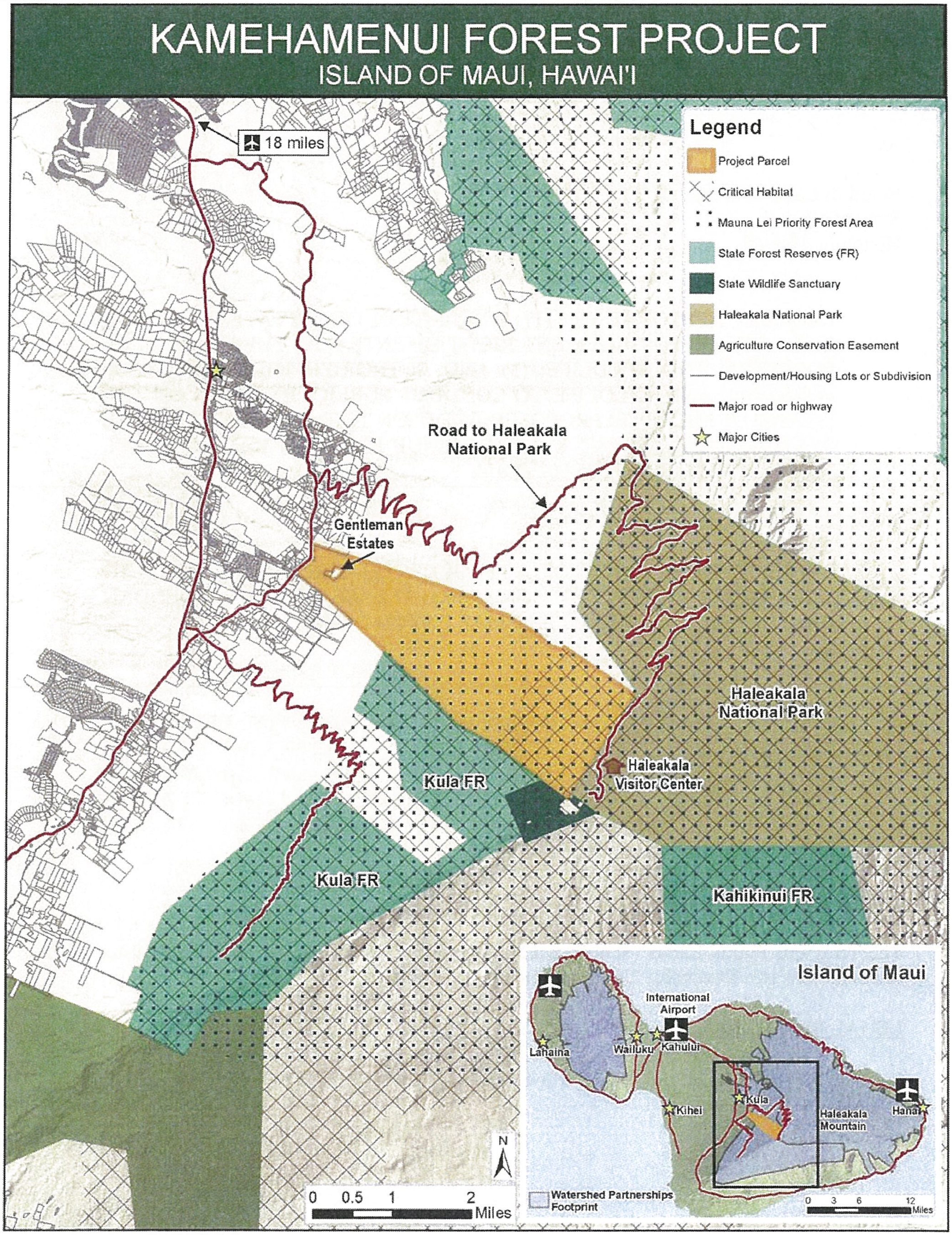
FOREST LEGACY
CONSERVATION LAND


KAMEHAMENUI FOREST PROJECT
ISLAND OF MAUI, HAWAI'I
18 miles
Legend
Project Parcel
Critical Habitat
Mauna Lei Priority Forest Area
State Forest Reserves (FR)
State Wildlife Sanctuary
Haleakala National Park
Agriculture Conservation Easement
Development/Housing Lots or Subdivision
Major road or highway
Major Cities
Road to Haleakala National Park
Gentleman Estates
Haleakala National Park
Haleakala Visitor Center
Kula FR
Kula FR
Kahikinui FR
Island of Maui
International Airport
Lahaina
Wailuku
Kahului
Kula
Kihei
Haleakala Mountain
Hana
Watershed Partnerships Footprint
0 3 6 12 Miles
N
0 0.5 1 2 Miles

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Forestry and Wildlife
Honolulu, Hawaii 96813

March 8, 2019

Board of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

MAUI

REQUEST APPROVAL OF: (1) ACQUISITION OF PRIVATE LANDS; (2) ISSUANCE OF MANAGEMENT RIGHT OF ENTRY TO THE DIVISION OF FORESTRY AND WILDLIFE; (3) AND AUTHORIZE THE DIVISION OF FORESTRY AND WILDLIFE TO CONDUCT PUBLIC HEARINGS ON THE ISLAND OF MAUI FOR PROPOSED ADDITION TO THE FOREST RESERVE SYSTEM, SITUATED AT KAMEHAMENUI, KULA, MAKAWAO, MAUI, TAX MAP KEY (2) 2-3-005:002 & 014.

AND

REQUEST DELEGATION OF AUTHORITY TO THE CHAIRPERSON TO ADMINISTER EXISTING GRAZING LEASE WITH BRENDAN BALTHAZAR REGARDING TAX MAP KEY (2) 2-3-005:002.

AND

DECLARE THAT, AFTER CONSIDERING THE POTENTIAL EFFECTS OF THE PROPOSED PROJECT AS PROVIDED BY CHAPTER 343, HRS, AND CHAPTER 11-200, HAR, THIS PROJECT WILL PROBABLY HAVE MINIMAL OR NO SIGNIFICANT EFFECT ON THE ENVIRONMENT AND IS THEREFORE EXEMPT FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT.

PRIVATE LANDOWNER:

The Trust For Public Lands (Seller), who is purchasing from Shizuka Asakawa, Trustee of the Shizuka Asakawa Revocable Trust Agreement (Landowner).

LEGAL REFERENCE:

Sections 107-10, 171-11 and 171-30, Hawaii Revised Statutes (HRS), as amended.

LOCATION:

ITEM C-1

Privately owned lands of Shizuka Asakawa, Trustee of the Shizuka Asakawa Revocable Trust Agreement, situate at Kamehamenui, Kula, Makawao, Maui, identified by Tax Map Key (2) 2-3-005:002 and 014, as shown on the attached map labeled **Exhibit A** and collectively referred to as "the Property".

AREA:

2-3-005:002:	3276.656 acres, more or less
2-3-005:014:	0.0275 acres, more or less
TOTAL:	3276.684 acres, more or less

ZONING:

State Land Use District:	Agriculture/Conservation
County of Maui Zoning:	Agriculture

CURRENT USE:

Parcel 2-3-005:002 is encumbered by an "Amended and Restated Grazing Lease and Hunting License Agreement" to Brendan Balthazar, see Remarks section for further discussion.

Parcel 2-3-005:014 is vacant.

CONSIDERATION:

Total purchase price is $9,830,000.00.

PURPOSE:

Forest Reserve purposes.

CHAPTER 343- ENVIRONMENTAL ASSESSMENT:

Pursuant to Section 343-5(a)(1), HRS, an environmental assessment (EA) is not required where State or county funds are being used for the acquisition of unimproved real property. As the subject lands are unimproved, an EA is not required. However, in an abundance of caution, to the extent that minor improvements, such as fencing and ranching equipment, are currently on the property, we have prepared an Exemption Notification, attached hereto as Exhibit E. Inasmuch as the Chapter 343 environmental requirements apply to Division's future management of the property, the Division will be responsible for compliance with Chapter 343, HRS, as amended.

REQUIREMENTS:

1) Obtain an appraisal report to determine the value of the properties to be acquired;
2) Process and obtain subdivision approval, as appropriate;

3) Provide survey maps and descriptions for the privately-owned property according to State DAGS standards;

4) Obtain a title report for the privately-owned property subject to review and approval by the Department;

5) Conduct a Phase I environmental site assessment and, if this Phase I identifies the potential for hazardous materials release or the presence of hazardous materials, conduct a Phase II environmental sampling and analysis plan and perform any and all remediation, abatement and disposal as may be warranted and as satisfactory to the standards required by the Federal Environmental Protection Agency and/or the State Department of Health, all at no cost to the State and to the satisfaction of the Department.

Further discussion of the Requirements is contained in the Remarks section.

BACKGROUND:

Kamehamenui Forest Property, on the north slopes of Haleakalā, in the Kula District of Maui, was listed for sale in 2016. The Property is the site of the historic Von Tempsky's Erehwon Ranch founded in 1875 and immortalized in bestselling novels about the family's adventures on the ranch. In an effort to protect this iconic landscape of Haleakala, the Division of Forestry and Wildlife in close partnership with the Trust for Public Lands (TPL) and the National Park Service began fundraising to acquire the Property for its public purposes. Acquisition of the Kamehamenui Forest Property will permanently protect over 3,276 acres of forest, native sub-alpine ecosystems and formerly forested grasslands. The Property includes two parcels, TMKs (2) 2-3-005:002 and 014, and consists of both agricultural and conservation zoned lands. Acquisition will secure high priority watersheds and native ecosystems that provide habitat for endangered wildlife. It will also add significant access and acreage for public outdoor recreation, as well as create opportunities for forest restoration, climate change mitigation and sustainable forestry. If acquired by the State, the intent is to add the Property to the Forest Reserve System. The Division will develop a comprehensive multi-use management plan, guided by community and stakeholder input.

Watershed management of the Kamehamenui Forest Property will add to the landscape of public and private conservation and forest restoration projects dotting this majestic Maui landscape. Two watershed partnerships encompass the majority of Haleakalā (150,500 acres). The Property was once part of the Leeward Haleakala Watershed Restoration Partnership (LHWRP), but was removed due to change in ownership, leaving a significant gap in watershed management. Nestled between Kula Forest Reserve and Haleakalā National Park, the Property is strategically located, and its acquisition is critical to achieve the overarching goal to restore the "mauna lei", the band of forest that once encompassed Haleakalā. Restoring this contiguous lei of habitat around the mountain, will ensure biological connectivity and restore ecological services in the form of watershed function, endangered species recovery, forest product opportunity, and climate change resilience.

The County of Maui estimates the demand for water on the NW slopes of Haleakalā and Wailuku will increase by 46.5% by 2030. Kamehamenui Forest contributes to the groundwater recharge of the Makawao aquifer which has been identified as a potential source to meet this demand.

According to the USGS groundwater recharge modeling dataset, the Property currently contributes approximately 3.37 million gallons of water per day. The Division estimates that habitat management and reforestation efforts could increase water production to 4.19 MGD, which translates into an additional 296 million gallons of water per year.

Acquisition of the Kamehamenui Property will also provide important forest access for the public, as it is immediately adjacent to Kula Forest Reserve, one of the most popular forest recreation areas on Maui. Acquisition will provide an additional forest access from Kekaulike Avenue to this popular recreational area and could also become an extension of the recreational experience in Kula Forest Reserve through the development of new trails.

This project will protect the Property's ecosystems, including a native subalpine ecosystem in the upper elevations (>8000'), which are designated federal critical habitat for 10 rare plant and bird species. These areas are relatively intact and native species are expected to regenerate naturally once the area is protected from feral ungulates. These areas are expected to be important for species adaptation to climate change as habitats shift under changing conditions. Lower elevation portions of the property are well suited for reforestation with ecologically and economically valuable species such as koa (*Acacia koa*) and sandalwood (*Santalum haleakalae* var. *haleakalae*).

Once acquired, the Division is planning habitat management and habitat restoration to enhance recovery efforts for the endangered wildlife including the ‘ua‘u, or Hawaiian petrel (*Pterodroma phaeopygia sandwichensis*), nēnē or Hawaiian goose (*Branta sandvicensis*), Hawaiian hoary bat - ‘ōpe‘ape‘a (*Lasirus cinereus semotus*), Maui parrotbill – kiwikiu (*Pseudonestor xanthophrys*), and the crested honeycreeper – ‘ākohekohe (*Palmeria dolei*). Acquisition of the Property will also provide additional outplanting and recovery sites for several critically endangered plant species including the ‘ahinahina or Haleakalā silversword (*Argyroxiphium sandwicense subsp. macrocephalum*). These areas will be vital for species migration due to climate change.

On the island of Maui, three wind energy complexes provide 72 MW of power, but have also resulted in incidental take of the federally listed endangered ua‘u, nēnē, ‘ope‘ape‘a, and Blackburn's sphinx moth (*Manduca blackburni*). Acquisition of the Kamehamenui Property will complement required mitigation being performed pursuant to the respective Habitat Conservation Plans for these species by protecting and restoring suitable habitat, managing threats, and increasing survival and reproductive success and contributing the overall recovery of those species. Additionally, keeping the Property undeveloped will ensure continued corridors for nesting seabirds between Haleakalā National Park and the ocean. Ua‘u are highly impacted by artificial lights that can cause disorientation, resulting in grounding and predation of downed birds.

The Kamehamenui Property acquisition will increase fresh water drinking supplies, increase opportunity for forest recreation, mitigate impacts of climate change, protect unique ecosystems, and provide critical habitat for endangered species. The project will preserve open space and protect the natural resources of the iconic landscape of Haleakalā for the residents and visitors of Maui for present and future generations in perpetuity.

REMARKS:

The Division has secured funding from both state and federal sources for this acquisition as follows:

State Capital Improvement Project Appropriation:	$4,000,000
U.S. Forest Service Forest Legacy Program:	$3,830,000
U.S. Fish and Wildlife Service Habitat Conservation Plan:	$2,000,000
TOTAL:	$9,830,000

The Division has also agreed to pay closing costs, including document preparation, recording fees and title insurance estimated at approximately $20,000, and will be using U.S. Forest Service Legacy Program grant funding for the project to cover those allowable grant costs. A draft warranty deed that has been negotiated for this acquisition is attached as **Exhibit B** and details the various funding sources and management requirements that will govern the future management of the Property.

The Division was assisted in conducting due diligence for this acquisition by Land Division and the Attorney General. An appraisal of the Property was prepared by CBRE, Inc dated November 6, 2018. The appraisal determined the total fair market value of the property to be $10,200,000.00. The appraisal was reviewed and accepted by both the U.S. Fish and Wildlife Service and U.S. Forest Service; both agencies accepted the fair market value and determined that the appraisal was complaint with the assignment and both the Uniform Standards of Professional Appraisal Practice (USPAP) and the Uniform Appraisal Standards for Federal Land Acquisition (UASFLA). A survey map and description has been prepared for the Property and will be submitted to the State Surveyor for review and approval.

A title report for the Property was provided by TPL. Upon of review of the report, the Division informed TPL, by letter dated November 9, 2018, of the exceptions that are acceptable to remain on title. Although not an exception on the title report, parcel (2) 2-3-005:002 in encumbered by an unrecorded Amended and Restated Grazing Lease and Hunting License Agreement (Lease), dated January 1, 2006, with Brendan Balthazar (Lessee). The Division does not object to the Lease under the conditions that the Lessee is in compliance, and the Lease document provided for review has not been amended, nor will be prior to closing. As a condition to closing, the Lessee will be required to execute a Certificate of Estoppel, a draft of which is attached as **Exhibit C**.

The Division believes that the certain use of the Property for grazing provided under this existing Lease can support the Division's long-term management objectives and funding requirements. With the overall wildfire threat in the region and to the Property, the Division plans to establish a network of managed fuel breaks, which may be maintained using prescribed grazing practices. Additionally, the Division anticipates restoring the forest over the course of several years and will need to manage the fuel loads during this period. The Lease provides the lessor the right to withdraw a portion or all of the leased premises at the lessor's discretion for any purpose. The Division's management plan may be compatible with a withdrawal of limited areas of the Property, phased over a period of time, rather the withdrawal the entire Property at once from the Lease. This may reduce the impacts to the Lessee's business operations, as well as provide for continued management of portions of the Property by the Lessee until the Division is prepared to assume management at the point of withdrawal. Prescribed grazing over the short-term in portions of the property may also support management of threats from encroachment by invasive weed species. Any hunting activities conducted pursuant to the Lease shall be subject to all applicable laws and rules regarding hunting on State lands. To support the ongoing management of the Property and Lease, the Division is requesting delegation to the Chairperson to negotiate and amend the Lease, as may be necessary, appropriate, and agreed upon by the Department and Lessee.

TPL retained Ford & Associates, Inc. (Ford) to conduct a Phase I Environmental Assessment (ESA) for the Property. The Phase I ESA identified a recognized environmental condition (REC), described as potential substance spills or leaks from containers at two locations on the western portion of the Property. Conditions observed included surface staining that appeared as oil, as well as distressed vegetation in the immediately surrounding area. To address the REC, Ford developed a remediation plan to remove and dispose of the containers and contaminated soil. TPL, through their Purchase and Sale Agreement (PSA) with the State (attached as **Exhibit D**), shall be obligated to complete the clean-up (which has already commenced) prior to the close of escrow.

Although not considered a REC, the Phase I ESA identified a dumpsite in a gulch on the Property. However, from observations of the site it appears that the dump consists of household refuse, with no evidence of hazardous substances or petroleum products. Ford, at TPL and the Division's request, surveyed the area and did not observe any hazardous materials present on the site. The Phase I ESA does note that portions of the Property are inaccessible due to terrain and heavy vegetation, preventing a thorough assessment of conditions in those areas.

In regards to the State's warranty deed form, the Seller has accepted the majority of the Department's standard provisions except for refusing to accept the indemnification for the release of hazardous materials. The Division agreed to the landowner's request, subject to Board approval, and the draft warranty deed for this acquisition omits provisions relating to the environmental condition of the Property entirely. The Land Division and the Attorney General have advised the Division about this matter and about the potential risks associated with the modification to the warranty deed. The Division acknowledges the expressed concerns and has reviewed the potential risk as outlined in the Phase I ESA. The Division believes that based on the historic low impact and rural use of the property (i.e.: as grazing and unimproved lands) as well as the intended management purpose as undeveloped wilderness, open space, and forest restoration, this Property has a low risk associated with hazardous materials impacts. Additionally, with TPL's obligation to complete the remediation plan for the documented REC site prior to the State's acquisition, the Division believes that the extensive public benefits that will be realized from this acquisition substantially outweigh the risks that may result from the potential for environmental-related issues discussed above. Based on the above considerations, the Division respectfully requests that the Board approve the acquisition pursuant to the foregoing terms and conditions.

Furthermore, the Division believes that the proposed transaction sufficiently protects the State from potential liability. First, the Lease contains a general indemnity provision. As the Lessee has had possession and control of parcel 2-3-005:002 (which constitutes almost the entire Property) for a longer period of time than the Seller, the Division believes that this is an acceptable substitute for the warranty deed indemnity. Second, even if the warranty deed indemnity is removed, the

State shall retain all rights to pursue potential claims against any appropriate party under law. The Division notes that in the PSA, TPL has represented that the Seller has committed up to $20,000 towards the cost of completing the remediation plan. However, acknowledgment of this representation by the State does not serve as a waiver of any right to pursue potential claims against any appropriate party under law.

Upon closing, the Division will enter into a management right-of entry for the Property. The Division will then proceed with conducting public hearings to add the Property to the Forest Reserve System. Upon completion, the Division will return to the Board to seek approval to designate the Property as part of the Forest Reserve System and obtain an Executive Order as appropriate.

RECOMMENDATION: That the Board:

1. Authorize the acquisition of the subject private lands under the terms and conditions cited above which are by this reference incorporated herein and further subject to the following:

   A. The terms and conditions of the attached draft deed document and the purchase and sale agreement, as may be amended;

   B. Review and approval by the Department of the Attorney General;

   C. Such other terms and conditions as may be prescribed by the Chairperson to best serve the interests of the State.

2. Authorize the issuance of a management right-of-entry permit to the Division of Forestry and Wildlife covering the subject area under the terms and conditions cited above, effective immediately upon acquisition by the State, which are by this reference incorporated herein and further subject to the following:

   A. The standard terms and conditions of the most current right-of-entry permit form, as may be amended from time to time;

   B. Such other terms and conditions as may be prescribed by the Chairperson to best serve the interests of the State.

   C. Delegate authority from the Chairperson to the Maui Branch Manager to issue access permits for these parcels under Chapter 171, HRS.

3. Pursuant to Section 183-11, HRS, as amended, authorize the Division of Forestry and Wildlife to conduct a public hearing on the Island of Maui regarding the proposed addition of the Property to the Forest Reserve System, Maui. Further, pursuant to 183-12, HRS, authorize the Chairperson to:

   A. Set the date, location and time of the public hearing; and

B. Appoint a hearing master(s) for the public hearing.

4. Delegate authority to the Chairperson to administer all aspects of the Amended and Restated Grazing Lease and Hunting License Agreement, dated January 1, 2006, with Brendan Balthazar.

5. Declare that, after considering the potential effects of the proposed project as provided by Chapter 343, HRS, and Chapter 11-200, HAR, this project will probably have minimal or no significant effect on the environmental and is therefore exempt from the preparation of an environmental assessment.

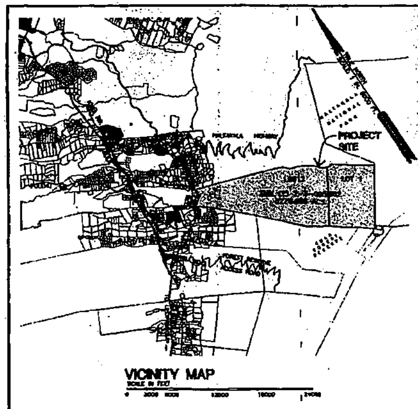
Respectfully Submitted,

David G. Smith
Administrator

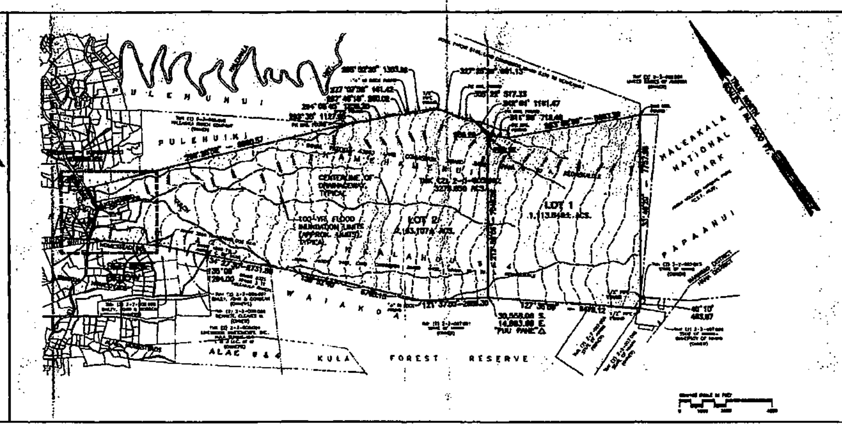
APPROVED FOR SUBMITTAL:

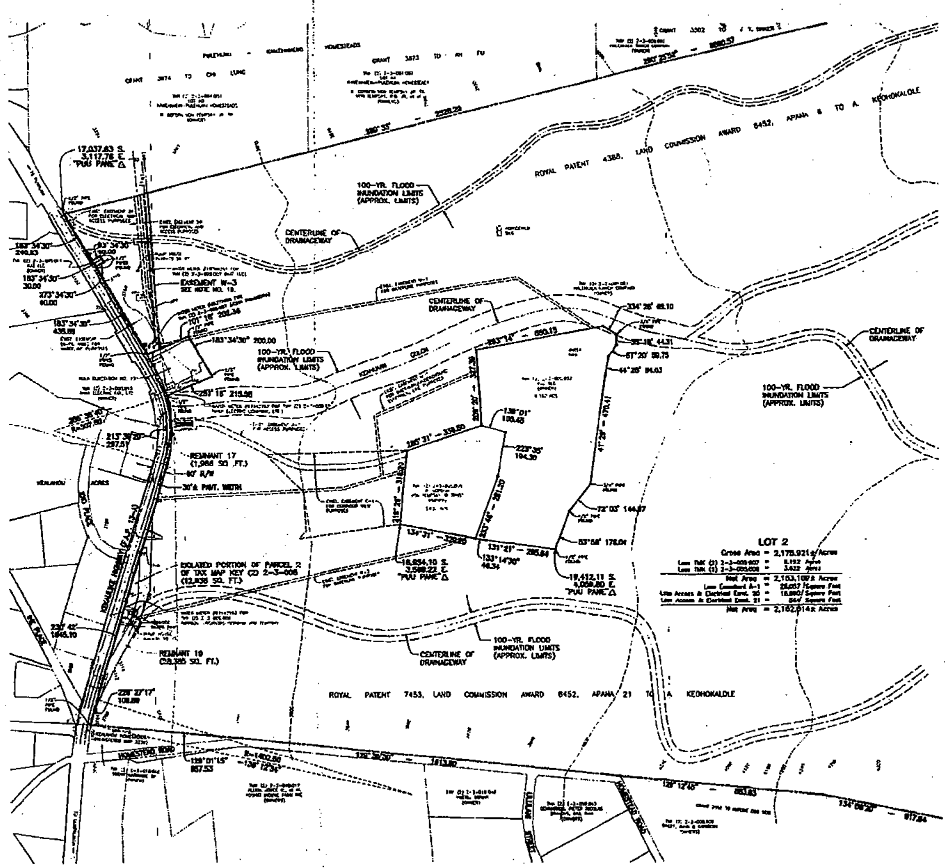
Suzanne D. Case, Chairperson

Exhibit A: Property Map
Exhibit B: Draft Warranty Deed
Exhibit C: Draft Certificate of Estoppel
Exhibit D: Draft Purchase and Sale Agreement
Exhibit E: Draft Declaration of Exemption



VICINITY MAP





INSET

TAX MAP KEY (2) 2-3-005:002

EXHIBIT A

PRELIMINARY

KEKAULIKE MAUKA SUBDIVISION

CONSOLIDATION OF REMNANT LOTS 17, 19, ISOLATED PORTION OF PARCEL 2 OF TAX MAP KEY (2) 2-3-005 AND THE REMAINDER OF PARCEL 2 OF TAX MAP KEY (2) 2-3-005 AND RESUBDIVISION OF SAID CONSOLIDATION INTO LOT 1 AND LOT 2 AND DESIGNATION OF EASEMENT W-3

BEING PORTIONS OF ROYAL PATENT 4388, LAND COMMISSION AWARD 8452, APANA 6 TO A. KEOHOKALOLE AND ROYAL PATENT 7453, LAND COMMISSION AWARD 8452, APANA 21 TO A. KEOHOKALOLE

KAMEHAMENUI, KEALAHOU 3 & 4, MAKAWAO, MAUI, HAWAII

SCALE: 1 IN. = 2,400 FT.

DATE: FEBRUARY 10, 2010

PREPARED FOR OWNER:

[illegible] LLC
C/O [illegible]
[illegible]

PREPARED BY:

RONALD M. FUKUMOTO ENGINEERING, INC.
[illegible]

RONALD M. FUKUMOTO
LICENSED PROFESSIONAL LAND SURVEYOR
CERTIFICATE NO. 5451
LICENSE EXPIRES 4/30/10

NOTES:

1. ALL AZIMUTHS AND [illegible] COORDINATES REFER TO GOVERNMENT SURVEY TRIANGULATION STATION "PUU PANE".
2. OWNERS OF ADJOINING PARCELS ARE TAKEN FROM THE COUNTY REAL PROPERTY TAX DIVISION RECORDS.
3. CONTOURS SHOWN ARE A COMBINATION OF ON GROUND TOPOGRAPHIC SURVEY BY RONALD M. FUKUMOTO ENGINEERING, INC. AND U.S.G.S. [illegible] QUADRANGLE MAP.
4. REMNANT LOTS 17, 19 AND ISOLATED PORTION OF PARCEL 2 OF TAX MAP KEY 2-3-005 [illegible]
5. EXIST. EASEMENT 26 [illegible] IS AN EASEMENT FOR ELECTRICAL [illegible] DATED MARCH 14, 1978.
6. EXIST. EASEMENT 27 [illegible] IS AN EASEMENT FOR ELECTRICAL [illegible] DATED MARCH 13, 1978.
7. EXIST. EASEMENT IS A PERPETUAL RIGHT AND EASEMENT FOR UTILITY (ELECTRICAL AND TELEPHONE) AND ACCESS PURPOSES [illegible] DATED MAY 27, 1983.
8. EXIST. EASEMENT A-1 [illegible] DATED NOVEMBER 28, 2001.
9. EXIST. 24-FT. WIDE EASEMENT A-1 [illegible] DATED NOVEMBER 28, 2001.
10. EXIST. 10-FT. WIDE EASEMENT U-1 [illegible] DATED NOVEMBER 28, 2001.
11. EXIST. 10-FT. WIDE EASEMENT U-1 [illegible] DATED NOVEMBER 28, 2001.
12. EXIST. EASEMENT W-1 [illegible] DATED NOVEMBER 28, 2001.
13. EXIST. EASEMENT W-2 [illegible] DATED NOVEMBER 28, 2001.
14. EXIST. EASEMENT C-1 [illegible] IS AN EASEMENT FOR VIEW CORRIDOR PURPOSES [illegible]
15. EXIST. 6-FT. WIDE EASEMENT [illegible]
16. EASEMENT W-3 [illegible] IS AN EASEMENT FOR WATERLINE PURPOSES AFFECTING LOT 2 OF THE KEKAULIKE SUBDIVISION IN FAVOR OF THE DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI.
17. ALL BOUNDARY CORNERS ARE MARKED AS NOTED.
18. DATES OF SURVEY: JULY [illegible] THROUGH AUGUST 3, 2009.
19. PURSUANT TO MAUI COUNTY CODE SECTION [illegible], THE COUNTY OF MAUI IS NOT RESPONSIBLE FOR ANY [illegible] UNLESS THE MAUI COUNTY COUNCIL HAS ACCEPTED [illegible] BY A RESOLUTION APPROVED BY A MAJORITY OF COUNCIL'S MEMBERS AT A REGULAR OR SPECIAL MEETING OF THE MAUI COUNTY COUNCIL.

SUBDIVISION FILE NO.

EXHIBIT B: DRAFT WARRANTY DEED)

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LAND COURT SYSTEM) REGULAR SYSTEM

Return by Mail (X) Pickup ( ) To:

Department of Land and Natural Resources
Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu, Hawaii 96813

Total Number of Pages: LOD No. Tax Map Key Nos. (2) 2-3-005:002 and 014

WARRANTY DEED

KNOW ALL MEN BY THESE PRESENTS:

THAT, effective as of the _____ day of ____________, 20, **THE TRUST FOR PUBLIC LAND**, a California nonprofit public benefit corporation, whose address is 101 Montgomery Street, Suite 900, San Francisco, CA 94104, hereinafter referred to as the "Grantor," for good and valuable consideration paid by the **STATE OF HAWAII**, by its Board of Land and Natural Resources, whose address is 1151 Punchbowl Street, Honolulu, Hawaii 96813, hereinafter referred to as the "Grantee," the receipt whereof is hereby acknowledged, does hereby grant, bargain, sell and convey unto the Grantee, the Grantee's successors and assigns, those certain parcel(s) of land situate at Kula, Island of Maui, State of Hawaii, containing an area approximately 3,276.684 acres, more particularly described in **Exhibit "A"** and delineated on **Exhibit "B"** both attached hereto and made parts hereof, said exhibits being, respectively, a survey description and survey map prepared by the Survey Division, Department of Accounting and General Services, State of Hawaii, designated as C.S.F. No. __________ and dated (hereafter, the "Property").

AND the reversions, remainders, rents, income and profits thereof, and all of the estate, right, title, and interest of the Grantor, both at law and in equity, therein and thereto.

TO HAVE AND TO HOLD the same, together with all improvements, rights, easements, privileges and appurtenances thereunto belonging or in anyways appertaining or held and enjoyed therewith in fee simple unto said Grantee, the Grantee's successors and assigns, forever, free and clear of all liens and encumbrances, except as described on **Exhibit "C"**, attached hereto and made a part hereof.

The Grantor, for itself, its successors and assigns, does hereby covenant with the Grantee, its successors and assigns, that the Grantor is lawfully seised in fee simple and possessed of the above-described Property that it has a good and lawful right and title to sell and convey the same as aforesaid, that the same is free and clear of all liens and encumbrances, except as noted herein and in **Exhibit "C"** hereto, and that it will and its successors and assigns, shall WARRANT AND DEFEND the same unto the Grantee, its successors and assigns, forever, against the claims and demands of all persons whomsoever.

The Grantor shall be responsible for payment of all real property taxes up to the date of execution of this Warranty Deed.

NOTICE OF FEDERAL PARTICIPATION

1. United States Department of Agriculture (USDA) Forest Service

Purpose & authority. The purpose of this acquisition is to effect the Forest Legacy Program in accordance with the provisions of the Cooperative Forestry Assistance Act of 1978, P.L. 95-313 as amended (codified at 16 U.S.C. 2101 *et seq.*) on the herein described land, which purposes include protecting environmentally important forest areas that are threatened by conversion to nonforest uses and for promoting forest land protection and other conservation opportunities. The purposes also include the protection and preservation of important scenic, cultural, fish, wildlife and recreational resources, riparian area, and other ecological values, and to ensure that the Property is available for the sustainable and cost-effective harvesting of forest products in a silviculturally sound manner, all of which meet the objectives of the Forest Legacy Program (FLP).

Transfer & disposal. This deed may be transferred or assigned only (i) to a government agency that (a) is eligible to hold this deed under the FLP, (b) is willing and able to hold this deed for the purpose for which it was created, and (c) expressly agrees to assume the responsibility imposed by the terms of this deed and (ii) with the consent of the State of Hawai'i, by its Board of Land and Natural Resources for the state lead agency, the Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW). If the deed holder ever ceases to exist or is no longer willing and able to hold this deed for the purpose for which it was created or carry out the responsibility imposed on the holder by the terms of this deed, the state lead agency must identify and select an appropriate entity to which this deed must be transferred.

The STATE OF HAWAI'I, by its Board of Land and Natural Resources, the owner of the Deed, pursuant to the grant agreement "Kamehamenui Forest Project" Grant Number 18-DG-11052021-217 awarded by the United States Department of Agriculture (USDA) Forest Service on June 27, 2018, to the grant recipient, STATE OF HAWAI'I, DLNR/DOFAW, acknowledges that the USDA Forest Service Forest Legacy Program funding for this acquisition is authorized by the Cooperative Forestry Assistance Act of 1978, P.L. 95-313, as amended (codified at 16 U.S.C. § 2101 *et seq.*), and that the interest acquired cannot be sold, exchanged, or otherwise disposed. Except, however, the USDA Secretary of Agriculture (Secretary) may exercise discretion to consent to such sale, exchange, or disposition upon the grant recipient's tender of equal valued consideration acceptable to the Secretary and under the requirement that the United States is reimbursed the market value of the interest, proportional to its contribution in the original acquisition, at the time of disposal. The grant agreement is housed in the USDA Forest Service Pacific Southwest Region Office at 1323 Club Drive, Vallejo, California, 94592, or in an archival facility per Agency policy.

The USDA Forest Service's proportionate share is 39%, which was determined by dividing the FLP's contribution to the acquisition by the value of the acquisition, at the time it was acquired, and expressing the result as a percentage.

The market value of this fee simple interest or the portion thereof that is disposed shall be the market value of such interest immediately before the disposal as determined by an appraisal that meets the Uniform Appraisal Standards for Federal Land Acquisitions (UASFLA) and is completed by a certified general appraiser approved by the grant recipient and the USDA Forest Service Pacific Southwest Region Office.

The form of the USDA Forest Service's reimbursement under this paragraph (whether it is received in cash or in kind) shall be in the sole and absolute discretion of the Secretary but shall in all events be used for FLP or similar conservation purposes. This fee simple deed shall not be deemed disposed in whole or in part until the USDA Forest Service receives reimbursement as provided in this paragraph.

No inaction or silence by the Secretary shall be construed as approval of a disposal or as an abandonment of this fee simple deed in whole or in part. Any purported disposal executed without the prior written consent of the Secretary will be null and void. The provisions of this paragraph shall survive any partial disposal.

If the deed owner is notified of a proposal to condemn all or any portion of the property subject to this fee simple deed, the grant recipient and the USDA Forest Service must immediately be notified.

Management objectives. The Property will be managed in a manner consistent with and in accordance with the FLP and a Multi-Resource Management Plan to ensure long-term sustainability and protection of the forest resources and other conservation values for which the Property was acquired. The initial plan will designate specific areas targeted for reforestation/afforestation, including a timeline to complete reforestation to achieve 75% cover across the Property within 10 years of acquisition, or as soon as silviculturally possible; subsequent plan updates will provide for maintenance of at least 75% forest cover thereafter.

There will be no surface disturbance of the property other than what is necessary for management activities which are needed for long-term forest health and sustainability. Disturbance must be limited but could include construction of new recreational or forest management roads or trails, construction or replacement of culverts or construction of structures that are necessary to meet the purposes of the acquisition including public access and forest-based recreation. There may be limited extraction of sand or gravel for onsite management activities. Such activities and construction will be outlined in the Multi-Resource Management Plan. Protection of the forest is the primary purpose of this acquisition; any management, structures, disturbance or alteration will be done only if needed for effective protection, management or restoration of the forest.

There will be no conveyance or subdivision of the subject property except that limited portions may be conveyed as part of bona fide boundary dispute resolutions in consultation with the appropriate Court. The holder of the subject property shall not enter into long term contracts, agreement, leases or easements that could impact the long-term title of this property or the purposes for which the property entered the FLP.

Ecosystem service markets. No agreements relating to ecosystem service markets shall be made regarding the Property that is or is likely to become inconsistent with the Purposes or Terms of this Deed, the terms of the FLP grant, State of Hawai'i Forest Action Plan or other documents incorporated by reference. If the State of Hawai'i wishes to enter such an agreement it must notify the USDA Forest Service explaining what the State proposes to do and explain why it believes market participation is compatible. The USDA Forest Service will respond with its denial or approval and include instructions if applicable.

2. U.S. Department of the Interior, Fish and Wildlife Service

The State of Hawai'i, DLNR, acknowledges that the Kamehamenui Forest Acquisition, located in Maui County, State of Hawai'i (the "Property"), was acquired, in part, with funds awarded by the U.S. Department of the Interior, Fish and Wildlife Service (the "USFWS") including grant funds received from the Cooperative Endangered Species Conservation Fund Habitat Conservation Plan (HCP) Land Acquisition Grant Program (CFDA #15.615) established under Section 6 of the Endangered Species Act, 16 U.S.C. § 1535 (the "Program"). The Program is administered by the USFWS, Division of Wildlife and Sport Fish Restoration, and its successors and assigns. The Property is subject to all the terms and conditions of Grant Award F18AP00085 (Award), the purpose of which is to enhance recovery efforts for federally listed endangered species, including Hawaiian petrel (*Pterodroma sandwichensis*) (Hawaiian name - ua'u), Hawaiian goose (*Branta sandvicensis*)(Hawaiian name - nēnē), Hawaiian hoary bat (*Lasiurus semotus*) (Hawaiian name - 'ope'ape'a), and Blackburn's sphinx moth (*Manduca blackburni*). A copy of the Award is kept on file at the offices of the USFWS, 911 NE 11th Avenue, Portland, Oregon 97232 and DLNR, Division of Forestry and Wildlife, 1151 Punchbowl Street, Room 325, Honolulu, Hawaii 96813.

DLNR acknowledges that the Property was acquired in part for the USFWS-approved purpose of protecting the Property in perpetuity to enhance recovery efforts for Hawaiian petrel, nēnē, Hawaiian hoary bat, and Blackburn's sphinx moth. The purpose of this acquisition project is to complement required mitigation being performed pursuant to the respective HCPs and to contribute to the long-term recovery of the covered species as well as for 10 additional endangered species. The acquisition is anticipated to protect and restore suitable habitat, increasing survival and reproductive success of those listed species. Acquisition and management of the Property is expected to result in an increase in the populations of each species, contributing to their overall recovery.

DLNR will develop a multi-resource management plan for the property which includes management strategies and recovery efforts to benefit federal listed species on the Property. The USFWS will be consulted during the development of the multi-resource management plan to ensure the forest management activities including but not limited to the harvesting of forest products will consider impacts to listed species. The Property possesses significant natural and open space values associated with habitat for fish and wildlife. DLNR's responsibilities and the federal interest shall last in perpetuity and pass to any successors unless provided for otherwise through disposal pursuant to 2 C.F.R. §200.311.

DLNR, as a recipient of Award funds, hereby confirms its obligations and responsibilities with regards to the Property pursuant to the terms and conditions associated with the Award, including the obligation to obtain the consent of the USFWS prior to the conveyance of any interest in the Property or the use of the Property for any purpose inconsistent with the USFWS-approved purpose. In the event the Property is no longer necessary for the purpose of the Award, DLNR will request disposition instructions from the USFWS, which will be provided in accordance with 2 C.F.R. §200.311(c).

Funding contributions toward the total purchase of the Property are as follows:

Contributing Partner	Amount	% of total
U.S. Forest Service - Forest Legacy Program/DLNR	$3,830,000	39%
State of Hawaiʻi CIP	$4,000,000	41%
U.S. Fish and Wildlife Service-HCP /DLNR	$2,000,000	20%
Total	$9,830,000	100%

DLNR shall not authorize or tolerate any activities on the Property that are incompatible with its originally authorized purpose, and will endeavor while working with partners, to stop these activities immediately should they occur without DLNR's permission.

DLNR acknowledges that there must be no discrimination during the useful life of the project (43 C.F.R. 17.204(c)(2)).

IT IS MUTUALLY AGREED that the terms "Grantor" and "Grantee," as and when used hereinabove or hereinbelow shall mean and include the masculine or feminine, the singular or plural number, individuals, associations, trustees, corporations, partnerships, or other entities and their and each of their respective successors in interest, heirs, executors, personal representatives, administrators and permitted assigns, according to the context thereof, and that if these presents shall be signed by two or more grantors, or by two or more grantees, all covenants of such parties shall be and for all purposes deemed to be their joint and several covenants.

The parties agree that this instrument may be executed in counterparts, each of which shall be deemed an original, and the counterparts shall together constitute one and the same instrument, binding all parties notwithstanding that all of the parties are not signatory to the same counterparts. For all purposes, including, without limitation, recordation, filing and delivery of this instrument, duplicate unexecuted and unacknowledged pages of the counterparts may be discarded and the remaining pages assembled as one document.

IN WITNESS WHEREOF, The Trust for Public Land, aforesaid, the Grantor herein, has caused these presents to be executed this _____ day of ____________, 201_, and the STATE OF HAWAII, by its Board of Land and Natural Resources, the Grantee herein, has caused the seal of the Department of Land and Natural Resources to be hereunto affixed and these presents to be executed this _____ day of ____________, 20__, both effective as of the day, month, and year first above written.

THE TRUST FOR PUBLIC LAND, a
California nonprofit public benefit corporation

Approved by the Board of Land and Natural Resources at its meeting(s) held on

____

____
Tily Shue, Senior Counsel

GRANTOR

APPROVED AS TO LEGALITY, FORM, EXCEPTIONS, AND RESERVATIONS:

____

____
Deputy Attorney General

Dated: ______________________________

STATE OF HAWAII

By ______________________________
SUZANNE D. CASE
Chairperson
Board of Land and Natural Resources

GRANTEE

CALIFORNIA ALL PURPOSE ACKNOWLEDGMENT

> A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA }
COUNTY OF ______________________ }

On __________________before me , _________________________________, Notary Public, personally appeared ____ who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature: __________________________________(Seal)

OPTIONAL
Description of Attached Document
Title or Type of Document: ______________________________ Number of Pages: ________
Document Date: ____________________ Other: _____________________________________

STATE OF HAWAII)
) SS.
COUNTY OF)

On this ____ day of __________, 20 __, before me appeared ___________________ and ___________________, to me personally known, who, being by me duly sworn, did say that they are the ____________________ and _________________________, respectively, of _________________________, a corporation, and that said instrument was signed in behalf of said corporation by authority of its Board of Directors, and the said _____________ and acknowledged said instrument to be the free act and deed of said corporation.

Notary Public, State of Hawaii

My commission expires:

EXHIBIT "A"

Legal Description of the Real Property

-ITEM I:-

All of that certain parcel of land (being portion(s) of the land(s) described in and covered by Royal Patent Numbers 4388 and 7453, Land Commission Award Number 8452, Apanas 6 and 21 to A. Keohokalole) situate, lying and being at Kamehamenui and Kealahou 3 & 4, Makawao, Island and County of Maui, State of Hawaii, being PARCEL 2, and thus bounded and described, to-wit:

Beginning at the northwest corner of this parcel of land, along the east side of Kekaulike Highway (F.A.P. 13-A), being also the southwest corner of Lot 40 of the Kamehameiki-Pulehuiki Homesteads, the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUU PANE", being 17,037.83 feet south and 3,117.76 feet east and running by azimuths measured clockwise from true South:

1.	289°	33'	00"	2,528.20	feet along Lots 40 and 44 of the Kamehameiki - Pulehuiki Homesteads, being also along Grant 3874 to Chi Lung and Grant 3873 to Ah Fu;
2.	290°	25'	52"	8,890.57	feet along Grant 3502 to J. T. Baker;

Thence along centerline of gulch, along Royal Patent 8140, Land Commission Award Number 5230 to Keaweamahi, for the next nine (9) courses, the direct azimuths and distances between points being:

3.	293°	35'	00"	1,127.65	feet;
4.	294°	08'	45"	1,258.20	feet;
5.	297°	46'	10'	260.02	feet;
6.	277°	07'	50"	161.42	feet;
7.	295°	52'	20"	1,303.98	feet;
8.	327°	25'	30"	991.13	feet;
9.	305°	22'	00"	517.33	feet;
10.	342°	01'	00"	1,181.47	feet;
11.	311°	58'	00"	719.46	feet;
12.	293°	52'	50"	5,693.29	feet along Royal Patent 8140, Land Commission Award Number 5230 to Keaweamahi;

13.	33°	46'	20"	7,757.96	feet along the Hawaii Volcano National Park (CSF 4532), being also along the remainder of R.P. 4388, L.C. Aw. 8452, Ap. 6 to A. Keohokalole and R.P. 7453, L.C. Aw. 8452, Ap. 21 to A. Keohokalole;
14.	40°	10'	00"	463.07	feet along Government Land being also along former Kahikinui Forest Reserve;
15.	127°	35'	50"	6,478.12	feet along Government Land being also along Kula Forest Reserve;
16.	121°	37'	50"	2,880.30	feet along same;
17.	135°	52'	40"	6,765.15	feet along same;
18.	134°	27'	30"	2,731.80	feet along Grant 9325 Apana 3 to Haleakala Ranch Company;
19.	135°	09'	00"	1,294.00	feet along Grant 4289 to Antone C. de Silva;
20.	134°	56'	20"	617.84	feet along Grant 3868 to Antone dos Reis;
21.	129°	12'	45"	883.83	feet along same;
22.	129°	35'	30"	1,613.80	feet along Homestead Road;
23.	129°	01'	15"	657.53	feet along portion of Lot 1-A of the Kealahou Homesteads (Reg. Map 2239);

Thence along the east side of Kekaulike Highway (F.A.P. 13-A) on a curve to the right with a radius of 1,402.50 feet, the chord azimuth and distance being:

24.	228°	27'	17"	109.89	feet;
25.	230°	42'	00"	1,045.10	feet along the east side of Kekaulike Highway (F.A.P. 13-A);

Thence along the east side of Kekaulike Highway (F.A.P. 13-A) on a curve to the left with a radius of 507.50 feet, the chord azimuth and distance being:

26.	213°	39'	20"	297.51	feet;
27.	281°	16'	00"	215.58	feet along Maui Electric Co. Ltd. Kula Substation No. 13, being also along the remainder of R.P. 4388, L.C. Aw. 8452, Ap. 6 to A. Keohokalole;
28.	183°	34'	30"	200.00	feet along same;

29.	101°	16'	00"	202.36	feet along same;
30.	183°	34'	30"	435.89	feet along the east side of Kekaulike Highway (F.A.P. 13-A);
31.	273°	34'	30"	40.00	feet along the remainder of R.P. 4388, L.C. Aw. 8452, Ap. 6 to A. Keohokalole;
32.	183°	34'	30"	30.00	feet along same;
33.	93°	34'	30"	40.00	feet along same;
34.	183°	34'	30"	240.93	feet along the east side of Kekaulike Highway (F.A.P. 13-A), to the point of beginning and containing a gross area of 3,289.47 acres, more or less, and a net area of 3,276.66 acres, more or less.

Exclusions:

a.	TMK: 2-3-05:07	9.192 Acres
b.	TMK: 2-3-05:08	3.622 Acres
		12.814 Acres

BEING THE PREMISES ACQUIRED BY WARRANTY DEED

GRANTOR: SHIZUKA ASAKAWA, Trustee of the Shizuka Asakawa Revocable Trust Agreement, dated April 19, 2016, with full powers to sell, mortgage, lease or otherwise deal with the land

GRANTEE: THE TRUST FOR PUBLIC LAND, a California nonprofit public benefit corporation, whose address is 101 Montgomery Street, Suite 900, San Francisco, CA 94104

DATED:
RECORDED:

-ITEM II:-

All of that certain parcel of land (being portion(s) of the land(s) described in and covered by Royal Patent Number 4388, Land Commission Award Number 8452, Apana 6 to A. Keohokalole) situate, lying and being at Kamehamenui, Makawao, Island and County of Maui, State of Hawaii, being PARCEL 14, and thus bounded and described as per survey of Erik S. Kaneshiro, Land Surveyor, with Austin, Tsutsumi & Associates, Inc., dated January 11, 2002, to-wit:

Beginning at the northwest corner of this parcel of land, along the east side of Kekaulike Highway (F.A.P. 13-A), the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUU PANE", being 17,278.28 feet south and 3,102.74 feet east and running by azimuths measured clockwise from true South:

35.	273°	34'	30"	40.00	feet along the remainder of R.P. 4388, L.C. Aw. 8452, Ap. 6 to A. Keohokalole;
36.	3°	34'	30"	30.00	feet along same;
37.	93°	34'	30"	40.00	feet along same;
38.	183°	34'	30"	30.00	feet along the east side of Kekaulike Highway (F.A.P. 13-A), to the point of beginning and containing an area of 1,200 square feet, more or less.

BEING THE PREMISES ACQUIRED BY WARRANTY DEED

GRANTOR: SHIZUKA ASAKAWA, Trustee of the Shizuka Asakawa Revocable Trust Agreement dated April 19, 2016, with full powers to sell, mortgage, lease or otherwise deal with the land

GRANTEE: THE TRUST FOR PUBLIC LAND, a California nonprofit public benefit corporation, whose address is 101 Montgomery Street, Suite 900, San Francisco, CA 94104

DATED:
RECORDED:

EXHIBIT "B"

Survey Map, C.S.F. No.

EXHIBIT "C"

The land described on Exhibit "A" and Exhibit "B" hereto is subject to the following:

1. Mineral and water rights of any nature.

2. Any and all existing roadways, trails, easements, rights of way, flumes and irrigation ditches.

3. -AS TO ITEM I:-

(A) GRANT

TO: MAUI ELECTRIC COMPANY, LIMITED AND HAWAIIAN TELEPHONE COMPANY, now known as HAWAIIAN TELCOM, INC.

DATED: May 27, 1983
RECORDED: Liber 17179 Page 535
GRANTING: a right and easement for utility purposes

(B) GRANT

TO: MAUI ELECTRIC COMPANY, LIMITED

DATED: March 14, 1978
RECORDED: Liber 12791 Page 735
GRANTING: a right and easement for utility purposes over Easements "20" and "21"

(C) GRANT

TO: MAUI ELECTRIC COMPANY, LIMITED

DATED: March 13, 1978
RECORDED: Liber 13521 Page 90
GRANTING: an easement of right-of-way over, under and across Easements "20" and "21" for pole and wire lines

(D) GRANT

TO: MAUI ELECTRIC COMPANY, LIMITED and HAWAIIAN TELEPHONE COMPANY, now known as HAWAIIAN TELCOM, INC.

DATED: May 27, 1983
RECORDED: Liber 17264 Page 478
GRANTING: a right and easement for utility purposes

(E) GRANT

TO: ROBERT GORDON VON TEMPSKY, JR. and MARY B. VON TEMPSKY, Trustees of the R. Gordon Von Tempsky, Jr. Trust established by Trust Agreement dated April 11, 1979, as amended

DATED: November 26, 2001
RECORDED: Document No. 2001-195576
GRANTING: a nonexclusive easement in favor of Tax Key (2) 2-3-005-007 for access purposes over Easement "A-1", more particularly described therein

(F) GRANT

TO: ROBERT GORDON VON TEMPSKY, JR. and MARY B. VON TEMPSKY, Trustees of the R. Gordon Von Tempsky Jr. Trust established by Trust Agreement dated April 11, 1979, as amended

DATED: November 26, 2001
RECORDED: Document No. 2001-195578
GRANTING: a nonexclusive right and easement in favor of Tax Key (2) 2-3-005-007 for utility purposes over Easement "U-1", more particularly described therein

(G) GRANT

TO: ROBERT GORDON VON TEMPSKY, JR. and MARY B. VON TEMPSKY, Trustees of the R. Gordon Von Tempsky, Jr. Trust established by Trust Agreement dated April 11, 1979, as amended

DATED: November 26, 2001
RECORDED: Document No. 2001-195580
GRANTING: a nonexclusive easement for waterline purposes over Easement "W-1", more particularly described therein

(H) GRANT

TO: ROBERT GORDON VON TEMPSKY, JR. and MARY B. VON TEMPSKY, Trustees of the R. Gordon Von Tempsky, Jr. Trust established by Trust Agreement dated April 11, 1979, as amended

DATED: November 26, 2001
RECORDED: Document No. 2002-021609

GRANTING: a nonexclusive easement for waterline purposes over Easement "W-2", more particularly described therein

(I) The terms and provisions contained in the following:

INSTRUMENT: DECLARATION OF COVENANTS, CONDITIONS AND RESTRICTIONS

DATED: November 26, 2001
RECORDED: Document No. 2002-021610

(J) GRANT

TO: ROBERT GORDON VON TEMPSKY, JR. and MARY B. VON TEMPSKY, Trustees of the R. Gordon Von Tempsky, Jr. Trust established by Trust Agreement dated April 11, 1979, as amended

DATED: November 26, 2001
RECORDED: Document No. 2002-021611
GRANTING: a nonexclusive easement for access purposes over Easement "A-1", more particularly described therein

(K) GRANT

TO: ROBERT GORDON VON TEMPSKY, JR. and MARY B. VON TEMPSKY, Trustees of the R. Gordon Von Tempsky, Jr. Trust established by Trust Agreement dated April 11, 1979, as amended

DATED: November 26, 2001
RECORDED: Document No. 2002-021612
GRANTING: a nonexclusive right and easement for utility purposes over Easement "U-1", more particularly described therein

(L) GRANT

TO: MAUI ELECTRIC COMPANY, LIMITED, and HAWAIIAN TELCOM, INC.

DATED: May 13, 2014
RECORDED: Document No. A-52910750
GRANTING: an easement for utility purposes

(M) GRANT

TO: STATE OF HAWAII, DEPARTMENT OF AGRICULTURE

DATED:	October 23, 2015
RECORDED:	Document No. A-58000819
GRANTING:	an easement for waterline purposes over Easement "2", being more particularly described therein, as shown on map attached thereto

(N) GRANT

TO:	STATE OF HAWAII, DEPARTMENT OF AGRICULTURE
DATED:	October 23, 2015
RECORDED:	Document No. A-58000820
GRANTING:	an easement over Easement "W-8" for waterline purposes, being more particularly described therein, as shown on map attached thereto

(O) Discrepancies, conflicts in boundary lines, shortage in area, encroachments or any other matters which a correct survey or archaeological study would disclose.

4. GRANT

TO:	VON TEMPSKY FP, a Hawaii limited partnership, and KULA RIDGE MAUKA LLC, a Hawaii limited liability company
DATED:	January 9, 2009, September 2, 2009 and September 3, 2009
RECORDED:	Document No. 2009-162580
GRANTING:	an easement for the transmission of water purposes, being more particularly described therein

5. Encroachments or any other matters as shown on survey map(s) prepared by Erik S. Kaneshiro, Land Surveyor, with Austin, Tsutsumi & Associates, Inc., dated January 11, 2002.

6. Claims arising out of customary and traditional rights and practices, including without limitation those exercised for subsistence, cultural, religious, access or gathering purposes, as provided for in the Hawaii Constitution or the Hawaii Revised Statutes.

7. Unrecorded Amended and Restated Grazing Lease and Hunting License Agreement dated January 1, 2006 with Brendan Balthazar as Lessee.

EXHIBIT C

Tax Map Key No. (2) 2-3-005:002

ESTOPPEL CERTIFICATE

KNOW ALL MEN BY THESE PRESENTS:

That, as of this ____ day of ___________, 2019, BRENDAN BALTHAZAR, whose address is ________________ ___________________________, hereinafter referred to as the "Lessee," certifies to the STATE OF HAWAII, by its Board of Land and Natural Resources, whose address is 1151 Punchbowl Street, Honolulu, Hawaii 96813, that:

(1) The Lessee is the lessee under that certain unrecorded Amended and Restated Grazing Lease and Hunting License Agreement ("Lease"), effective January 1, 2006, which expires on December 31, 2020; and

(2) A true and correct copy of the Lease is attached hereto as Exhibit 1; and

(3) Said Lease has never been amended, modified, or supplemented; and

(4) To date, the Lessee has not exercised the option to extend the term of the Lease for one (1) additional ten (10) year period pursuant to Paragraph 39 of the Lease; and

(5) Shizuka Asakawa, as Trustee of the Shizuka Asakawa Revocable Trust Agreement, dated April 19, 2016, is the current Lessor under the Lease; and

(6) The Lessee is not in default in any respect as of this date, nor has any event occurred which with the passage of time or the giving of notice would constitute a default; and

(7) The Lessee is not aware of the Lessor being in default in any respect as of this date, nor has any event occurred which with the passage of time or the giving of notice would constitute a default; and

(8) There are no claims for damages, rents due, or other liability which the Lessee is aware of against the Lessor arising out of Lease or performance of the terms, covenants or conditions of the Lease; and

(9) The Lessee has not undertaken or initiated the undertaking of any "Lienable Construction," as that term is

AMENDED AND RESTATED GRAZING LEASE AND HUNTING LICENSE AGREEMENT

This Grazing Lease Lease ("Lease") is made effective as of January 1, 2006, and is by and between KJZ LLC, a Hawaii limited liability company, hereinafter called "Lessor", and Brendan Balthazar, hereinafter called "Lessee".

Whereas, Lessor is the owner of certain land located on the island of Maui, state of Hawaii;

Whereas, Lessee is desirous of utilizing Lessor's property for grazing livestock and the operation of a ranch; and

Whereas, Lessor and Lessee, entered into that Grazing Lease and Hunting License Agreement, effective January 1, 2006, with a term expiring on December 31, 2015, and the parties desire to amend and restate such agreement and extend its term by five years by entering into this Lease, which expires as set forth below on December 31, 2020;

Now, therefore, in consideration of the rent hereinafter set forth and of the covenants and conditions herein contained and on the part of the Lessee to be kept, observed and performed, the parties hereto agree as follows:

1. Lease of Premises. Subject to the terms and conditions contained in this Lease, Lessor does hereby demise and lease to the Lessee the lands located in the District of Kula, island and county of Maui, state of Hawaii, and designated as Maui tax key nos. 2-3-005-002-0000 (area approximately 3,335 acres (hereinafter referred to as the "Premises"), to have and to hold the Premises unto the Lessee, together with the water system, pipes, tanks, troughs, and other similar equipment or improvements on the Premises, for grazing and cattle ranch purposes only.

Reserving, however, unto the Lessor, the following:

(i) All prehistoric and historic remains found in, on or under the Premises.

(ii) The ownership of improvements of whatever kind or nature, including but not limited to fences and stock water systems located on the Premises prior to or on the commencement date of this Lease, excluding those improvements constructed during the term of the Lease unless otherwise provided herein.

EXHIBIT 1

(v) The right and privilege to issue written permits to individuals to hunt, subject to the rules and regulations issued by the Hawaii State Department of Agriculture; provided, however, that the parties hereto acknowledge that Lessee is obtaining hunting license rights as provided for in more detail in the last paragraph of the Lease, which the parties agree and acknowledge do not represent an interest in real property.

2. Term. This Lease shall continue for a term ("Term) of ten (10) years commencing on January 1, 2006, and expiring on December 31, 2020.

3. Rent. Rent payable by Lessee to Lessor for the Term shall be One Thousand Two Hundred Dollars ($1,200) per month, representing a total rental amount due every six months of $7,200. Lessee shall pay to Lessor, in arrears, the rent for successive six-month periods of the Term, with the first payment being due on or before July 1, 2006

4. Fencing. Lessee will, wholly at Lessee's own cost and expense, keep and maintain in good order and in a stock-proof condition throughout the period of this Lease the fences constructed by Lessee and those now existing on the Premises. Lessee will maintain and, if necessary, construct, at its own cost and expense, such fences as may be required for Lessee's use of the Premises by any law, rule, regulations or ordinance now in force or that may hereafter be enacted.

5. Taxes, Assessments, Etc. for Lessee's Operations. The Lessee shall pay or cause to be paid, when due, all taxes, rates, assessments and other outgoings of every description with respect to Lessee's use and operation of the Premises, during the term of this Lease.

6. Repair and Maintenance. Lessee will, at Lessee's own expense, at all times during the said term, maintain well and substantially repair, maintain, amend, and keep the Premises and improvements thereon covered by this Lease in good order, condition and repair, reasonable wear and tear excepted, and in a strictly clean and sanitary condition. It is agreed and understood that Lessee shall not dispose of rubbish or any waste materials anywhere on the Premises. Lessee will allow the Lessor or its agents free access to the Premises at all reasonable times for the purpose of examining the same and determining whether the covenants herein are being fully observed and performed, and will make good at Lessee's own cost and expense all repairs and amendments reasonably necessary of which notice shall be given within thirty (30) days after the giving of such notice; or if such repairs cannot be reasonably completed within said thirty (30) days, Lessee shall proceed diligently to complete such repairs as soon as reasonably possible thereafter; and shall

or transfer or assign this Lease or any interest therein, either voluntarily or by operation of law, and any such occupancy, use, transfer or assignment so made shall be null and void and shall entitle Lessor, immediately and without notice, to terminate this Lease and be restored to the sole, exclusive possession of the Premises.

13. Mortgage. The Lessee will not mortgage, hypothecate or pledge the Premises or any portion thereof or any interest therein without the prior written approval of the Lessor, which approval may be withheld in the sole discretion of Lessor, and any such mortgage, hypothecation or pledge without such approval shall be null and void.

14. Indemnity. The Lessee will indemnify, defend and hold the Lessor harmless from and against any claim or demand for loss, liability or damage, including claims for property damage, personal injury or death, arising out of any accident on the Premises or occasioned by any act or nuisance made or suffered on the Premises, or by any fire thereon, or growing out of or caused by any failure on the part of the Lessee to maintain the Premises in a safe condition, or by any act or omission of the Lessee, including aerial drift or the use of chemicals, pesticides, herbicides, fungicides, mematicides and plant growth regulations (hormones), and from and against all actions, suits, damages and claims by whomsoever brought or made by reason of the nonobservance or nonperformance of any of the terms, covenants and conditions herein or the rules, regulations, ordinances and laws of the federal, state, municipal or county governments.

15. Costs of Litigation. In case the Lessor shall, without any fault on its part, be made a party to any litigation commenced by or against the Lessee (other than condemnation proceedings), the Lessee shall and will pay all costs and expenses incurred by or imposed on the Lessor including reasonable attorney's fees; furthermore, the Lessee shall and will pay all costs and expenses including reasonable attorney's fees that may be incurred by or paid by the Lessor in enforcing the covenants and agreements of this Lease, in recovering possession of the Premises or in the collection of delinquent rent, taxes and any and all other charges.

16. Liability, Property Damage and Insurance. The Lessee will indemnify and hold the Lessor harmless from claims or demands by third persons and from any losses or damages, including without limitation reasonable attorney's fees, for property damages or personal injury or death arising out of any accident or happening on or from the Premises, including nonexclusive access rights-of way, and will at its own expense, carry and keep in force during the term of the Lease, or any extension, a policy or policies of landlord's, owner's, and tenant's liability insurance or the equivalent with minimum limits of not less than Three Million Dollars ($3,000,000.00) each

consistent with the provisions of Section 1(iii)(3) shall remain the property of the Lessee to the extent such improvements have not been fully depreciated. As provided for in more detail in Section 24, it is the intent of the parties that, to the extent this lease terminates for any reason when the Lessee has any ownership interests in such improvements, the Lessor shall have the option of either purchasing such improvements for the undepreciated cost of them or providing the Lessee the right to remove such improvements.

19. Breach. Time is of the essence of this agreement and if the Lessee shall fail to yield to pay any rent or any part thereof at the times and in the manner aforesaid, or shall become bankrupt, or shall abandon the Premises, or if this Lease and the Premises shall be attached or otherwise be taken by operation of law, or if any assignment be made of the Lessee's property for the benefit of creditors, or shall fail to observe and perform any of the covenants, terms and conditions herein contained and on its part to be observed and performed, and such failure shall continue for a period of more than thirty (30) days after delivery by the Lessor of a written notice of such breach or default by personal service, registered mail or certified mail to the Lessee at its last known address, the Lessor may, at once re-enter the Premises or any part thereof, and upon or without such entry, at its option, terminate this Lease without prejudice to any other remedy or right of action for arrears of rent for any preceding or other breach of contract; and in the event of such termination, all buildings and improvements thereon shall remain and become the property of the Lessor.

20. Construction Bond. Lessee will, before undertaking any "Lienable Construction" (as defined below) on the Premises, notify Lessor of the fact that such Lienable Construction is to be undertaken. Lessor may, at such time, require Lessee to display the ability to pay for any such Lienable Construction, which determination of ability to pay shall be made by Lessor in its reasonable judgment. If, in Lessor's reasonable judgment, Lessee does not have the ability to pay for the Lienable Construction in question, Lessee shall deposit with Lessor a bond or certificate in form and amount with surety reasonably satisfactory to Lessor, guarantying the completion of the applicable Lienable Construction, free and clear of all mechanics' and materialmen's liens. For purposes hereof, the term "Lienable Construction" shall mean the construction of any alteration, addition or improvement on the Premises (i) which costs in excess of Twenty Thousand Dollars ($20,000) (or, when aggregated with all other alterations, additions or improvements to be constructed at any one time, aggregate in excess of Twenty Thousand Dollars ($20,000)) and (ii) with respect to which a statutory mechanics' or materialmen's lien may be asserted.

21. Condemnation. If at any time, during the term of this Lease, any portion of the Premises should be condemned, or required for public

(a) Lessee acknowledges that it is familiar with the Premises and has made such independent investigations and reviewed such documents as it deems necessary or appropriate concerning the use of the Premises for grazing and ranching purposes, including, but not limited to, any desired investigations or analysis of the economic value of the Premises or the feasibility of utilizing the Premises for the purposes intended by Lessee and permitted by Lessor; the size, dimensions, location or topography of the Premises; any surface, soil, subsoil or other physical conditions of or affecting the Premises; all present or future governmental laws, statutes, rules, regulations, ordinances, limitations, restrictions or requirements concerning the use, density, location or suitability of the Premises (collectively "Regulations"), including, but not limited to, zoning, subdivision, land use, environmental, ecological, building code, or other such Regulations; the necessity or availability of any general or special plan amendments, rezoning, zone variances, conditional use permits, building permits, environmental impact reports, parcel or subdivision maps or any other governmental permits, approvals or acts (collectively the "Permits"); the necessity or existence of any dedications, fees, charges, costs or assessments that may be imposed in connection with any Regulations or the obtaining of any required Permits; all other matters concerning the conditions and use of the Premises.

(b) Lessee is relying solely upon its own inspection, investigation and analysis of the foregoing matters in executing this Lease and is not relying in any way upon any representations, statements, agreements, warranties, studies, reports, descriptions, guidelines or other information or material furnished by Lessor or its representatives, whether oral or written, express or implied, of any nature whatsoever regarding any of the foregoing matters.

(c) Lessee will be using the Premises "as is", in its present state and condition, without representation by Lessor or its representatives as to any matter, whether or not expressly mentioned above. No patent or latent condition affecting the Premises in any way, such as, but not limited to, the matters listed in subparagraph (a) of this paragraph 25, whether or not known or discoverable or hereafter discovered, shall affect Lessee's rights or obligations as set forth in this Lease, nor shall give rise to any right of damages or otherwise against Lessor.

26. <u>Good Husbandry, Conservation Program and Hazardous Materials</u>.

(a) The Lessee shall at all times practice good husbandry with regard to the use of the Premises for the use herein permitted and shall carry out a program of conservation developed by the Lessee. Good husbandry and conservation includes taking reasonable steps to ensure that clear pasture and be determined by a single arbitrator, if the parties so mutually agree, or in the absence of such agreement by a board of three impartial arbitrators. Either the single arbitrator or the two arbitrators appointed by the parties as hereinafter provided in case a single arbitrator cannot be agreed upon shall be persons experienced and knowledgeable, in the case of disputes involving rental or land value, in the appraisal of real property, or in all other disputes, in agricultural land management matters. In case a single arbitrator cannot be agreed upon, the impanelment of a board of three arbitrators shall be as follows: The party desiring to have the matter in dispute submitted to arbitration shall give the other party written notice of such desire and shall name one arbitrator in such notice. Within twenty (20) days after the receipt of such notice, the other party shall name a second arbitrator, and in case of failure to do so the party who first named an arbitrator may have the second arbitrator selected or appointed by a judge of the Circuit Court of the Second Circuit, State of Hawaii, and the two arbitrators so appointed in either manner shall select and appoint a third arbitrator, and if the two arbitrators so appointed shall fail to appoint the third arbitrator within twenty (20) days after the naming of the second arbitrator, either party may have the third arbitrator selected or appointed by one of said judges, and the three arbitrators so appointed shall thereupon proceed to determine the matter in question, disagreement or difference, and the decision of any two of them shall be final, conclusive and binding upon the parties, all as provided in Chapter 658, Hawaii Revised Statutes, as the same may be amended, and judgment may be entered upon any such decision by the Circuit Court as provided in said statute. In all cases of arbitration, each of the parties hereto shall pay the expense of its own attorneys and witnesses, and all other expenses of such arbitration shall be divided equally between the parties. If the issue or dispute submitted to arbitration involves the payment of money, the amount in dispute shall be deposited by the party to be charged with payment into an interest-bearing account, with an institution acceptable to both parties, pending the completion of the arbitration and interest accrued shall be paid with payment of the principal after the award.

29. Notices. Any notice to be given to or served upon any of the parties hereto shall be deemed to have been sufficiently given or served for all purposes when actually delivered by messenger or by certified mail, return receipt requested, delivered as follows (supplementary copies may be deemed delivered if sent by fax or email, and expressly recognized by the party receiving the correspondence):

In the case of Lessor:
KJZ LLC
c/o West Maui Financial Services
5095 Napilihau Street, Suite 202
Lahaina, Hawaii 96761

Lessee which provides that said mortgagee will not disturb the possession and other rights of Lessee so long as Lessee performs its obligations hereunder and that said mortgagee will accept Lessee as Lessee of the Premises under the terms and conditions of this Lease in the event of acquisition of title by said mortgagee through foreclosure proceedings or otherwise, and which further provides that Lessee will agree to recognize the holder of such mortgage as the Lessor in such event, said agreement to be expressly binding upon the successors and assigns of Lessee and of the mortgagee and upon anyone purchasing the Premises at any foreclosure sale. Lessee and Lessor agree to execute and deliver any appropriate instruments necessary to carry out the agreements in this section contained. Any such mortgage to which this Lease shall be subordinated may contain such other terms, provisions and conditions as the mortgagee deems usual or customary. Lessee also agrees that if it fails at any time to execute, acknowledge or deliver any such instrument requested by Lessor, then Lessor may, in addition to any other remedies available to them, execute, acknowledge and deliver such instrument as the attorney-in-fact of Lessee and in Lessee's name; and Lessee hereby makes, constitutes and irrevocably appoints Lessor as its attorney-in-fact for that purpose. The word "mortgage" as used herein includes mortgages, deeds of trust or other similar instruments and modifications, consolidations, extensions, renewals, replacements and substitutes thereof.

36. Time Of Essence. Time is of the essence of each provision of this Lease.

37. Section Headings. Section headings of this Lease are for convenience only and if there be any conflict, the text shall control.

38. Entire Lease. The parties agree that their entire contract has been stated herein and that this instrument and all of the terms and conditions herein contained, supersede any prior, oral, or written agreements or representations made by or between the parties in respect of any matter relating hereto, all of which have been merged herein.

39. Option to Extend Term. The Lessee shall have the option to extend the term of this Lease for one (1) additional ten (10) year period upon the condition that there is no default in performance or observance of any covenant or condition of this Lease of which a notice of default has been given to the Lessee at the expiration of the initial term described in paragraph 2; provided, however, that in case of any such default which cannot with due diligence be cured prior to the expiration of the initial term, if the Lessee shall have proceeded promptly after the service of notice of default with due diligence to cure such default, the Lessee may, nevertheless, be entitled to such extended term. Except with respect to the amount of the rent payable during the one (1) additional ten (10) year period and except that there shall be no privilege to

It is the intention and understanding of the Lessor and Lessee that all hunting rights and any hunting activities conducted on the Premises will be conducted consistent with and subject to the rules and regulations issued by the Hawaii State Department of Agriculture, any applicable federal or local laws, and to further reasonable rules and regulations of Lessee. It is also the intention of the parties that while the license rights granted hereunder do not represent rights or interests in real property, all of the other provisions of this Lease concerning liability and indemnification shall apply. Without limiting the preceding sentence, for example, the provisions of paragraphs 14 and 15 (concerning the Lessee's obligation to indemnify the Lessor against claims and costs, including litigation costs, with respect to Lessee's use of the Premises) and paragraph 16 (concerning the obligation to obtain the appropriate amount of insurance and make Lessor as an additional insured) apply to the hunting rights provided in this paragraph. The insurance obtained pursuant to paragraph 16 shall include coverage for liability for hunting activities conducted directly or indirectly by Lessee.

IN WITNESS WHEREOF, the Lessor and the Lessee have executed this Lease effective as of the 1st day of January 2006.

LESSOR:

KJZ LLC, a Hawaii limited liability company

John Pridjian
CFO and Authorized Signatory

LESSEE:

BRENDAN BALTHAZAR

Brendan Balthazar

EXHIBIT D

AGREEMENT OF SALE
(Kamehamenui Property)

This is an Agreement of Sale ("Agreement") dated ________________, 2019, between **The Trust for Public Land,** a California nonprofit public benefit corporation, authorized to do business in the State of Hawai'i ("Seller"), and the **State of Hawaii,** by its Board of Land and Natural Resources ("Buyer").

RECITALS

A. The address and telephone numbers of the parties to this Agreement are as follows: Telephone numbers are included for information only:

SELLER:

The Trust for Public Land
101 Montgomery St., Ste. 900
San Francisco, CA 94104
Attn: Tily Shue
tily.shue@tpl.org
Tel: (415) 800-5308
FAX: (415) 495-0541

Copies of any notices to Seller should also be sent to:

The Trust for Public Land
1003 Bishop St. Ste. 740
Honolulu, Hawaii 96813
Attn: Stephen Rafferty
stephen.rafferty@tpl.org
Tel: (808) 524-8560
FAX: (808) 566-0005

BUYER:

State of Hawaii
Board of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809-0621
Attn: Suzanne D. Case, Chairperson
suzanne.case@hawaii.com
Tel: (808) 587-0401
FAX: (808) 587-0390

Copies of any notices to Buyer should also be sent to:

State of Hawaii
Dept. of Land and Natural Resources
Land Division
1151 Punchbowl Street, Room 220
Honolulu, Hawaii 96813
Attn: Ian C. Hirokawa
ian.c.hirokawa@hawaii.gov
Tel: (808) 587-0420
FAX: (808) 312-6357

B. Before the Deed Recordation(as defined below), the parties expect that Seller will purchase certain real property, commonly called the "Kamehamenui" or "Erehwon Ranch" property, located on the Island of Maui, Hawaii, Tax Map Key Nos. (2) 2-3-005:002 and (2) 2-3-005:014, described in Exhibit A and depicted in Exhibit B, both attached to this Agreement and incorporated herein by this reference, together with Seller's interest in all improvements, fixtures, timber, water, oil, gas and mineral and metallic mines of every kind or description, if any, and all rights appurtenant to the property, including but not limited to timber rights, water rights, grazing rights, access rights, and geothermal rights, if any will be referred to in this Agreement as the "Property."

C. Seller has an existing binding legal right to purchase the Property from its current owner,Shizuka Asakawa, Trustee of the Shizuka Asakawa Revocable Trust Agreement ("Asakawa"). Buyer wishes to purchase the Property from Seller and Seller wishes to sell the Property to Buyer on the terms and conditions set forth in this Agreement.

THE PARTIES AGREE AS FOLLOWS:

1. **Purchase and Sale**. Seller agrees to sell the Property to Buyer and Buyer agrees to buy the Property from Seller on the terms and conditions set forth herein.

2. **Purchase Price**. The purchase price for the Property is Nine Million Eight Hundred Thirty Thousand Dollars ($9,830,000.00) (the "Purchase Price"). The Purchase Price will be payable, in cash or immediately available funds, on Deed Recordation, as defined in Section 7.

3. **Effective Date**. This Agreement will be effective on the date that it is signed by both parties hereto and approved as to form, legality, exceptions and reservations by the Attorney General on behalf of Buyer, as shown on the signature pages to this Agreement (the "Effective Date").

4. **Conditions Precedent to Closing**. The parties' respective obligations to close the purchase and sale of the Property are conditioned upon all of the following happening at least one (1) business day before the Closing (as defined in Section 7(a) below):

(a) Seller receives approval of the transaction which is the subject of this Agreement by the Seller's Board of Directors which approval is subject to said Board's sole discretion;

(b) Buyer has approved the title, physical, and structural condition of the Property not later than March 8, 2019 (the "Review Deadline");

(c) Buyer has approved the environmental condition of the Property;

(d) Buyer receives approval by the State of Hawaii, Board of Land and Natural Resources ("BLNR") to enter into this Agreement and to acquire the Property, which approval is subject to the Board's sole discretion;

(e) Buyer receives all sources of grant funding which are to be used together to purchase the Property;

(f) Seller has provided Buyer with copies of the Property Information (as defined in Section 5(a)(ii) below) provided to Seller by the current landowner and the results of Seller's due diligence. To the best of Seller's knowledge the Property Information contains all encumbrances, restrictions, and obligations, both recorded and unrecorded, pertaining to the Property;

(g) Brendan Balthazar executes an estoppel certificate in connection with that certain unrecorded Amended and Restated Grazing Lease and Hunting License Agreement, dated as January 1, 2006 between KJZ LLC, as lessor, and Brendan Balthazar, as lessee (the "Grazing Lease"), for Tax Map Key No. (2) 2-3-005:002, and it is delivered to Escrow;

(h) The current landowner, Asakawa, as Lessor under the Grazing Lease, and Buyer execute an Assignment and Assumption of Grazing Lease for Tax Map Key No. (2) 2-3-005:002, and it is delivered to Escrow; and

(i) Satisfaction of all obligations stated in this Agreement by both Buyer and Seller, within the periods provided in this Agreement (if any).

If any condition precedent is not satisfied or waived by the benefited party, Seller or Buyer may terminate this Agreement by written notice to the other party and to the Escrow Holder; in which event the Parties will have no further obligation to each other under this Agreement and Buyer will not be liable for any damages.

5. **Condition of the Property**.

(a) Buyer and Seller agree that, before the Review Deadline, as defined in Section 4(b) above:

(i) Buyer will have had the opportunity to study all aspects or circumstances of the Property which Buyer deems material or relevant;

(ii) Buyer will have had received from Seller the documents described in Exhibit C attached hereto and incorporated by this reference, which sets forth Property-related information (the "Property Information");

(iii) Buyer will have had access to the Property; and

(iv) Buyer will have had the opportunity to make all inspections and verifications which Buyer deems necessary for the completion of Buyer's due diligence review for the transaction covered by this Agreement.

(b) Except as otherwise expressly provided in this Agreement, Buyer hereby acknowledges and agrees that the sale of the Property hereunder is and will be made on an "as is, where is" basis and that neither Seller, nor any attorney, representative, agent, or employee of Seller has made, or will make, and except for Seller's representations and express warranties set forth in this Agreement, Seller specifically negates and disclaims, any representations, warranties, or guaranties of any kind or character whatsoever, whether express or implied, oral or written, past, present, future, or otherwise, of, as to, concerning or with respect to the Property.

(c) Buyer acknowledges that Seller has represented to Buyer that Section 5.5 of that certain Option Agreement dated as of February 14, 2018, as amended, between Seller, as "Buyer" thereunder, and Asakawa, as "Seller" thereunder, pursuant to which Seller acquires the Property from Asakawa, provides as follows:

"Remediation of Environmental Issues. Should Buyer determine, in its sole discretion, based on its investigation of the Property, that the environmental conditions on the Property are unacceptable (an "**Environmental Problem**"), Buyer will notify Seller of the Environmental Problem. At Seller's election, either (a) Seller will pay for the cost of up to Twenty Thousand and 00/100 Dollars ($20,000.00) towards the cost of the remediating the Environmental Problem, which shall be paid as a credit to Buyer at the Close of Escrow; or (b) Seller will hire a licensed contractor approved by Buyer to remedy all Environmental Problems by Close of Escrow to Buyer's satisfaction, as determined by Buyer in Buyer's sole and absolute discretion, including, if commercially reasonable given the nature of an Environmental Problem, obtaining a "no further action" letter from the appropriate government agency. In addition, if an Environmental Problem exists and if Seller cannot comply with the terms of subsection (b) above by the Close of Escrow (if Seller elects such option), in addition to and without waiving any of Buyer's other remedies hereunder, Buyer may extend the Option Term and/or the Closing Date until the Environmental Problem has been remedied as provided herein."

(d) Buyer acknowledges that Seller has provided to Buyer (i) that certain Phase I Environmental Assessment Report dated June 8, 2018 ("Phase I ESA") prepared by Ford Associates, Inc. ("Ford"), (ii) that certain updated Phase I ESA, prepared by Ford and dated as of February 13, 2019 (the "Phase I Update"), and (iii) that certain Proposal to Conduct Removal and Disposal of Containers and Associated Petroleum Contaminated Soil (PCS) Located on the Western Portion of the Kamehamenui Property, in Kula, Maui, Hawaii, dated January 31, prepared by Ford, to perform cleanup on the Property of materials and soils identified in the Phase I ESA/Phase I Update (the "Remediation Plan"). Buyer further acknowledges that Seller has represented to Buyer that Seller has commenced cleanup pursuant to the Remediation Plan, and such cleanup will be completed no later than the close of escrow.

6. **Due Diligence**. Seller has provided to Buyer the Property Information and the opportunity to investigate and review a preliminary title report, the Property Information, and the physical condition of the Property, which investigation and review must be completed on or before the Review Deadline. If Buyer determines that it is dissatisfied with the condition of the Property, then Buyer may terminate this Agreement by delivering written notice to Seller on or before the Review Deadline. If Buyer fails to deliver any such written termination notice to Seller on or before the Review Deadline, then Buyer will be deemed to have elected to proceed to close escrow and acquire the Property.

7. **Escrow and Closing.**

(a) Seller has opened an escrow (the "Escrow") with Title Guaranty of Hawaii, Inc., 235 Queen Street, Honolulu, Hawaii, 96813 Attn: Jeremy Trueblood (the "Escrow Holder") for the purpose of consummating the purchase and sale of the Property (the "Closing"). Buyer and Seller will approve and submit joint escrow closing instructions. "Deed Recordation" which is defined as the date on which the Warranty Deed is recorded and the Purchase Price paid will occur on or before March 29, 2019, unless extended by agreement of the parties.

(b) Buyer and Seller must deliver (or cause to be delivered) all final, fully executed documents and all funds into Escrow at least two (2) business days before the Deed Recordation.

(c) Seller will pay 100% of any documentary tax or real property transfer tax arising out of the conveyance of the Property. Any other closing expenses, fees, and charges will be borne by the Buyer; provided that the sum of these closing expenses, fees, and charges and the cost of standard coverage provided for in Section 9 borne by the Buyer shall not exceed $20,000.00, which is payable solely from the U.S. Forest Service - Forest Legacy Program/DLNR grant, and to the extent the total sum exceeds $20,000.00, the amount in excess shall be borne by the Seller.

8. **Title**. Seller will cause the Property to be conveyed to Buyer by a Warranty Deed in the form attached hereto as Exhibit D, incorporated herein by this reference (the "Deed"), a fee simple interest in the Property, free and clear of all monetary liens and encumbrances, except as shown in Exhibit A to the Deed.

Seller will pay or cause to be paid all property taxes up to the date of recordation of the Deed.

9. **Title Insurance.** Seller will provide an ALTA standard coverage, owner's policy of title insurance, with regional exceptions, in the full amount of the Purchase Price, insuring that title to the Property is vested in Buyer upon Deed Recordation subject only to the exceptions noted in Section 8. Buyer will pay for the cost of standard coverage. If Buyer elects to obtain any endorsements and/or an extended coverage policy, Buyer will pay the difference between ALTA standard coverage and the increased premium for the endorsements and/or extended coverage. If Buyer or the Title Company requires a survey, the cost of the survey will be at Buyer's expense and such survey must be completed at least two (2) business days before the Deed Recordation.

10. **Seller's Promise not to Further Encumber.** Seller may not, without the prior written consent of the Buyer, make any leases, contracts, options, or agreements whatsoever affecting the Property that would in any manner impede Seller's ability to perform hereunder and deliver title as agreed herein.

11. **Seller's Representations**. Seller represents and warrants that:

(a) Subject to the conditions precedent set forth in Section 4, Seller will, before the Deed Recordation, have the power to sell, transfer and convey all right, title and interest in and to the Property;

(b) To Seller's actual knowledge, there is no action, suit, litigation, arbitration, or other proceeding pending or threatened that in any manner affects the Property;

(c) Subject to the conditions precedent set forth in Section 4, Seller has full power and authority to execute and deliver this Agreement and to consummate the transactions provided herein. The persons signing this Agreement for Seller have full power and authority to sign for Seller and to bind it to this Agreement;

(d) Seller has no actual knowledge of any violations of any law, order, ordinance, or regulation affecting the Property;

(e) Seller has not received notice and has no knowledge of, any pending or threatened condemnation of all or part of the Property;

(f) This Agreement and the other documents to be executed by Seller hereunder, upon execution and delivery thereof by Seller, will have been duly entered into by Seller, and will constitute legal, valid and binding obligations of Seller, subject to the conditions precedent set forth in Section 4, and subject to applicable bankruptcy, insolvency, reorganization, moratorium, or similar laws or equitable principles affecting or limiting the rights of contracting parties generally. Neither this Agreement nor anything provided to be done under this Agreement violates or will violate any contract, document, understanding, agreement, or instrument to which Seller is a party or by which it is bound;

(g) Except for the Grazing Lease, Seller has no actual knowledge of any unrecorded agreements affecting the Property ;

(h) Seller represents and warrants that it is not a "foreign person" as defined in Section 1445 of the Internal Revenue Code. Seller's United States Taxpayer Identification Number is 23-7222333;

(i) Seller represents and warrants that it is a nonprofit public benefit corporation duly organized, validly existing and in good standing under the laws of the State of California;

(j) Seller represents and warrants, to Seller's actual knowledge that the Property is not subject to any investigation by any governmental authority or any judicial or administrative proceedings alleging the material violation of or liability under any hazardous materials law, or any outstanding written order or agreement with any governmental authority or private party relating to any hazardous materials laws or hazardous materials claims;

(k) Seller agrees to disclose to Buyer all material findings regarding the condition of the Property that Seller may discover and are not contained in the preliminary title report delivered to Buyer.

12. **Buyer's Representation**. Buyer represents and warrants that subject to approval by the BLNR, which approval is at its sole discretion, Buyer has all the requisite power and authority to enter into this Agreement and to consummate the transactions contemplated hereby.

13. **Risk of Loss**. All risk of loss will remain with Seller until Deed Recordation. If the Property is destroyed or damaged after the Effective Date of this Agreement and before Deed Recordation, then Buyer or Seller may, at their option elect to terminate this Agreement with no damages accountable to Buyer.

14. **Notices**. All notices pertaining to this Agreement will be in writing delivered to the parties hereto by facsimile or email transmission, personally by hand, courier service or Express Mail, or by first class mail, postage prepared, at the addresses set forth in Recital A. All notices will be deemed given: (a) if sent by mail, when deposited in the mail, first class postage prepared, addressed to the party to be notified; (b) if delivered by hand, courier service or Express Mail, when delivered; or (c) if transmitted by email or facsimile, when transmitted; provided the sender receives no indication the transmittal was unsuccessful. The parties may, by notice as provided above, designate a different address for notices.

15. **Remedies Upon Default**. If Buyer or Seller defaults in the performance of any of their respective obligations under this Agreement, then Seller or Buyer will, in addition to any and all other remedies provided in this Agreement or by law or equity, have the right of specific performance against the defaulting party.

16. **No Broker's Commission**. Each party represents to the other that it has not used a real estate broker in connection with this Agreement or the transaction contemplated by this Agreement. Each party further represents that it has not and will not pay or receive a broker's commission or finders' fee for this transaction. If any person asserts a claim for a broker's commission or finder's fee against one of the parties to this Agreement, then the party on account of whose conduct the claim is asserted will hold the other party harmless from said claim.

17. **Time of the Essence; Dates**. Time is of the essence to this Agreement. If any date specified in this Agreement falls on Saturday, Sunday or a public holiday, then such date will be deemed to be the succeeding day on which the public agencies and major banks are open for business.

18. **Binding on Successors**. Subject to approval by the Board of Land and Natural Resources and the Seller's Board of Directors, which approvals are at each

Board's sole discretion, this Agreement will be binding not only upon the parties but also upon their heirs, personal representatives, assigns, and other successors in interest.

19. **Additional Documents**. Seller and Buyer agree to execute such additional documents, including escrow instructions, as may be reasonable and necessary to carry out the provisions of this Agreement.

20. **Additional Documents to be Provided by Seller to Buyer**. Seller agrees to provide to Buyer or Escrow Holder before the Deed Recordation a resolution of the Board of Directors of Seller authorizing the transaction contemplated by this Agreement, the execution, delivery, and performance of this Agreement, any other obligation of Seller contemplated by this Agreement, and authorizing the person who will sign this Agreement to do so on behalf of Seller.

21. **Assignment**. Buyer may not assign its interests under this Agreement without the written consent of Seller.

22. **Entire Agreement; Modification; Waiver**. This Agreement constitutes the entire agreement between Buyer and Seller pertaining to the subject matter contained in it and supersedes all prior and contemporaneous agreements, representations, and understandings. No supplement, modification, or amendment of this Agreement will be binding unless executed in writing by all parties. No waiver of any of the provisions of this Agreement will be deemed or will constitute a waiver of any other provision, whether or not similar, nor will any waiver constitute a continuing waiver. No waiver will be binding unless executed in writing by the party making the waiver and agreeable to both parties.

23. **Counterparts**. This Agreement may be executed in counterparts; each of which will be deemed an original and which together will constitute one and the same agreement.

24. **Severability**. Each provision of this Agreement is severable from any and all other provisions of this Agreement. Should any provision(s) of this Agreement be for any reason unenforceable, the balance will nonetheless be of full force and effect.

25. **Governing Law**. This Agreement will be governed by and construed in accordance with the laws of the State of Hawai'i.

26. **Survival of Close of Escrow**. All representations, warranties, covenants, conditions, agreements, and other obligations set forth in this Agreement will survive the Closing and Deed Recordation and will not merge therein unless specifically stated otherwise in this Agreement.

EXHIBIT D

IN WITNESS of the foregoing provisions the parties have signed this Agreement below:

SELLER:

THE TRUST FOR PUBLIC LAND, a California nonprofit public benefit corporation

By: ____________________________

Tily Shue
Senior Counsel and Legal Director

Date: ________________, 2019

BUYER:

STATE OF HAWAII

By: ______________________________

Name: SUZANNE D. CASE
Chairperson,
Board of Land and Natural Resources

Approved by the Board of Land and Natural Resources at its meeting held on ____________________, 2019.

APPROVED AS TO FORM, LEGALITY, EXCEPTIONS, AND RESERVATIONS:

____

Name: DAVID D. DAY
Deputy Attorney General

EXHIBIT E

EXEMPTION NOTIFICATION

Regarding the preparation of an environmental assessment pursuant to Chapter 343, HRS and Chapter 11-200, HAR

Project Title:	Kamehamenui Forest Property Acquisition
Project / Reference No.:	N/A
Project Location:	Tax Map Key (2) 2-3-005:002 and 014; Kula, Maui County
Project Description:	The Division of Forestry and Wildlife in partnership with the Trust for Public Lands is acquiring the Kamehamenui Forest Property (pending approval by the Board of Land and Natural Resources). The property is located on the north slopes of Haleakalā, in the Kula District of Maui. Acquisition of the Kamehamenui Forest Property will permanently protect over 3,276 acres of forest, native sub-alpine ecosystems and formerly forested grasslands for public purposes. The Property consists of both agricultural and conservation zoned lands. Parcel (2) 2-3-005:002 is currently encumbered by a grazing lease and portions of the parcel contain ranching infrastructure (fencing, water tanks, corrals). Higher elevation portions of the property are undeveloped land. Acquisition will secure high priority watersheds and native ecosystems that provide habitat for endangered wildlife. It will also add significant access and acreage for public outdoor recreation, as well as create opportunities for forest restoration, climate change mitigation and sustainable forestry.
Chap. 343 Trigger(s):	Use of State Funds
Exemption Class No(s).:	Class 1; Action Type 45. Acquisition of land or interests in land.
Cumulative Impact of Planned Successive Actions in Same Place Significant?:	No. The proposed action is a stand-alone, one-time use of funds for land acquisition that does not involve cumulative impacts from planned, successive actions of the same kind, in the same place, over time.
Action May Have Significant Impact on Particularly Sensitive Environment?:	No. Portions of the project area, particularly the upper elevation portions are environmentally sensitive because endangered species

and native ecosystems are present. There will be no impact, however, because the use of funds to purchase the land will not change the environment.

Analysis: This land-acquisition action will not have a significant effect on the environment. The Division believes that the use of state funds for land acquisition will probably have minimal or no significant negative effects on the environment; does not fund an activity that causes any material change of use of land or resources beyond that previously existing; and is exempt from the preparation of an environmental assessment in accordance with Sections 343-5 and 343-6, HRS; Section 11-200-8, HAR; and Exemption Class 1, Action Type 45 on the Exemption List for the Department of Land and Natural Resources, reviewed and concurred on by the Environmental Council on June 5, 2015.

Consulted Parties: DLNR Land Division: Advises that the exemption is proper. DLNR Office of Conservation and Coastal Lands: Concurs with exemption.

Declaration: The Board finds that this project will probably have minimal or no significant effect on the environment and declares that this project is exempt from the preparation of an environmental assessment.

Kamehamenui Forest Project

Kula, Island of Maui

Kamehamenui Forest Project (Photo by Sakamoto Properties)

The Vision

In the ahupua'a of Kamehamenui, on the northwest slopes of Haleākala, is the site of the historic Von Tempsky Erehwon Ranch founded in 1875. The property is now listed for sale and a partnership between The Trust for Public Lands, State, County and Federal agencies is seeking to protect the property's tropical mesic forest and subalpine ecosystems through fee purchase of its approximately 3,277 acres. Acquisition of this historic property would provide a wide range of public benefits, from increasing water recharge to aquifers that supply drinking water, to preserving open space, and providing access to mauka recreational opportunities.

The upper elevations of Kamehamenui contain native subalpine shrublands that are important habitat for numerous endangered species, including the 'ua'u, or Hawaiian petrel (*Pterodroma phaeopygia sandwichensis*), and the nēnē or Hawaiian goose (*Branta sandvicensis*). If acquired by this partnership, the upper elevations would be fenced and the feral ungulate populations would be removed. Biological surveys will be conducted to inventory existing natural resources and assess existing threats to this unique native plant community.

The lower two-thirds of the property primarily contains pasture that is well suited for reforestation with ecologically and economically valuable species such as koa (*Acacia koa*) and sandalwood (*Santalum haleakalae* var. *haleakalae*). Reforestation will increase habitat for the endangered Hawaiian hoary bat - 'ōpe'ape'a (*Lasirus cinereus semotus*), Maui parrotbill – kiwikiu (*Pseudonestor xanthophrys*), and the crested honeycreeper – 'ākohekohe (*Palmeria dolei*), but can also be managed for sustainable production. If acquired, a comprehensive multi-use management plan will be developed for Kamehamenui guided by community and stakeholder input.

Koa restoration area in Kahikinui Forest Reserve

Clean Drinking Water for the Future

Based on the groundwater recharge data from *USGS Investigations Report 2015-5164*[1], in its current state, Kamehamenui provides 3.37 million gallons of water per day (MGD) to the Makawao aquifer. To estimate the amount of water that could potentially be captured after habitat restoration is completed, we conservatively increased recharge rates based on values from adjacent forested areas. Based on our GIS calculation, we estimate that habitat management and reforestation efforts at Kamehamenui will increase water production to 4.19 MGD, which translates into an additional 296 million gallons of water per year.

Cabin at Polipoli Spring State Recreation Area

Access for Forest Recreation

Kamehamenui is immediately adjacent to Kula Forest Reserve (FR), which is one of the most popular forest recreation areas on Maui. Automated counters documented an average of 400 vehicles per month visiting this forest reserve. Kula FR contains 30.5 miles of public access trails and is also a popular hunting area. Also contained within the FR is the Polipoli Springs State Recreation Area, a very popular camping destination. Acquisition of Kamehamenui would not only provide an additional forest access from Kekaulike Avenue to this popular area, but could also become an extension of the recreational experience in Kula FR through the development of new trails.

Ungulate fencing installation

Feral Ungulate removal

Feral ungulates graze and browse native plants, resulting in habitat degradation, loss of biodiversity and soil erosion. For restoration efforts to succeed at Kamehamenui, ungulate browsing pressure must be removed. To accomplish this, watershed fencing would be installed, followed by ungulate removal efforts. The Division will follow established policies and procedures to employ effective tools and methods for the elimination of feral ungulates from the parcel, as has been done successfully on windward and leeward Haleakalā.

Invasive plant removal

Regular weed control missions will be a necessary component of watershed management at Kamehamenui. Alternating between the subalpine and mesic fence units, week long trips will be done quarterly to control targeted invasive species. To develop a weed control strategy, DOFAW will utilize multispectral imagery for the entire forest reserve. With the advent of drone technology, there have been significant advances in UAV (unmanned aerial

[1] Izuka SK, Engott JA, Bassiouni M, Johnson AG, Miller LD, Rotzoll K, Mair A. 2016. Volcanic aquifers of Hawai'i—hydrogeology, water budgets, and conceptual models: U.S. Geological Survey Scientific Investigations Report 2015-5164.

vehicle) services. Asset mapping can now be done very quickly, at a higher degree of quality and accuracy, and 30% cheaper than traditional fixed winged aircrafts.

Native subalpine shrublands

Forest Restoration

The upper elevations of Kamehamenui are relatively intact and are expected to regenerate native habitat and biodiversity naturally once feral ungulates are removed. For some rare species, outplanting will be employed to ensure that ecosystem function is restored to the greatest degree practicable. The lower elevations of Kamehamenui are well suited to reforestation with ecologically and economically valuable species such as koa and sandalwood, which are some of the highest valued of all Hawaii's forest products and can be managed under sustainable selective harvesting prescriptions compatible with ecological function. With the help of interns and volunteers, the Division and its partners have already successfully outplanted 150,000 native trees in on leeward Haleakalā within the Nakula Natural Area Reserve and Kahikinui Forest Reserve.

'Iliahi (Santalum haleakalae var. haleakalae)

Watershed Partnership

Two watershed partnerships encompass the majority (150,500 acres) of Haleakalā Mountain. Kamehamenui was originally a member of the Leeward Haleakala Watershed Restoration Partnership (LHWRP), but was removed due to change in ownership, leaving a significant gap in watershed management. Acquiring Kamehamenui will secure its participation, which is necessary to achieve the overarching goal of the partnership to restore the "mauna lei", or the band of forest that once encompassed Haleakalā.

Endangered Species

Much of Kamehamenui is designated federal critical habitat for 10 rare plant and bird species. Habitat management and restoration will enhance recovery efforts for the endangered ʻuaʻu, nēnē, ʻōpeʻapeʻa, kiwikiu and the ʻākohekohe, by increasing available suitable habitat, managing threats, and increasing survival and reproductive success. Acquisition of this parcel will also provide additional outplanting and recovery sites for several critically endangered plants species.

Nēnē (Branta sandvicensis)

Monitoring and Adaptive Management

In the three to five years following the acquisition of the property, another set of multispectral imagery will be taken to monitor the success of weed control and planting efforts. This innovative and quantitative analysis of land management activities will be used to guide decision making for all future actions, informing an adaptive management process and allowing the Division to quickly respond to new threats or needs.

Climate Change

The Pacific Island Climate Change Cooperative and the State Wildlife Action Plan both identified climate change as a major threat to the forest birds of Hawai'i. Increasing temperature will allow vectors of avian disease to invade higher elevations, reducing and in some cases eliminating available habitat. Creating corridors to facilitate distribution shifts is a priority strategy for mitigating this predicted climate change impact to our native forest birds.

Carbon Sequestration

The Division recognizes that any reforestation project requires sustained funding and commitment to succeed. We are actively pursuing innovative new revenue streams based on payment for ecosystem services provided by the lands under the Division's jurisdiction. Carbon sequestration (i.e.: the long-term storage of atmospheric carbon dioxide to mitigate for global climate change) is an ecosystem service for which a market, for both compliance and voluntary carbon offsets, already exists. Earlier this year a video was produced on the Division's forestry carbon credit projects and it is available on vimeo at: https://vimeo.com/201803558. It highlights the successful Maui reforestation efforts occurring in the Kahikinui Forest Reserve and the Nakula Natural Area Reserve.

Several recent developments make the timing right for an exploration of methods for carbon capture and innovative financing for natural resources within the Hawaiian Islands. At the global scale, the Paris Climate Accord has secured international commitments. Locally, Governor Ige recently announced as part of his Sustainable Hawaii Initiative, commitments to protect 30% of our priority watershed areas by 2030. The Aloha+ Challenge has been endorsed by all levels of government as a benchmark to measure Hawaii's sustainability, with public and private sector support.

Haleakalā silversword outplanting volunteer

For the People of Maui

The Kamehamenui Forest Project will increase fresh water drinking supplies, increase opportunity for forest recreation, mitigate impacts of climate change, protect unique ecosystems, and provide habitat for endangered species. Most importantly, the project protects open space and the natural resources of the iconic landscape of Haleakalā for the residents and visitors of Maui, in perpetuity.

Conservation Funding Needs

Hawai'i Forest Legacy Program	$4,000,000
U.S. Fish and Wildlife Service	$2,000,000
Hawai'i Legacy Conservation Funds	$1,000,000
Other Public Funding Needed	$3,000,000
Total Estimated Funding Need	**$10,000,000**

Enhance, protect, conserve and manage Hawaii's unique and limited natural, cultural and historic resources held in public trust for current and future generations of the people of Hawaii nei, and its visitors, in partnership with others from the public and private sectors.

The Trust for Public Land creates parks and protects land for people, ensuring healthy, livable communities for generations to come.

FOR MORE INFORMATION:

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APPENDIX K

Interim Adaptive Management Plan

New Appendix associated with HCP Amendment

1.0 Introduction

This Interim Adaptive Management Plan (AMP) identifies specific measures that Auwahi Wind will implement if the estimated fatality rate, evaluated as described below, exceeds the value needed to ensure compliance with the permitted take value over the permit term. As discussed in Section 4.1.7 of the HCP Amendment, Auwahi Wind implemented baseline minimization measures in 2018 and will continue to apply these measures for the duration of the permit, unless specific adaptive management triggers are reached that would initiate an adaptive management action. The Interim AMP will be in effect upon permit issuance and until it is superseded by the AMP. The AMP will be developed using the results of the ongoing risk analysis (Section 7.4.1.3 of the HCP Amendment) and will be provided to the US Fish and Wildlife Service (USFWS) and State of Hawaii Department of Land and Natural Resources: Division of Forestry and Wildlife (DOFAW) for review by April 30, 2020. All terms and acronyms are defined in the Auwahi Wind HCP Amendment.

2.0 Evaluation Schedule

The effectiveness of the minimization measures in place at Auwahi Wind will be evaluated on a routine basis to ensure compliance with the permitted take value. These evaluations will take place as part of routine reporting tasks and scheduled agency reviews, as well as in response to observed take.

Table 1. Schedule for Regular Evaluation of Minimization Measures.

Period	Action	Timeframe
Immediate Evaluations	Summary of Take Report	Due within 3 weeks of observed take
Semi-Annual Evaluation	HCP Semi-Annual Compliance Report	Due January 31
Annual Evaluations	HCP Annual Compliance Report	Due August 31
	AMP Review	Scheduled with USFWS and DOFAW after Annual Report
Scheduled Evaluations	Adaptive Management Action Review	Due February 28
	If adaptive management actions are required, implement adaptive management actions[1]	Due March 31

1. See Follow-up Evaluation in Section 2.4.

To track compliance, Auwahi Wind will use Evidence of Absence (EoA) to evaluate the Post-Construction Mortality Monitoring (PCMM) data and calculate the Baseline Fatality Rate (BFR) which is then compared to the Threshold Value (TV). The TV for Auwahi Wind is 6.45 based on analysis presented in Section 7.4.1.1 of the HCP Amendment.

Additionally, Auwahi Wind will track the BFR relative to each of the tiers of take (Table 2) to support agency discussions during routine reviews.

Table 2. Average Take Rates for Each Tier Over 20 Years.

Tier	Maximum Take	Average BFR
4	81	4.05
5	115	5.75

The details from the schedule are described in the following subsections.

2.1 Immediate Evaluations

Summary of Take Report (on Observed Fatalities): Auwahi Wind notifies USFWS and DOFAW of any bat fatality observed during PCMM or incidentally and submits a Summary of Take report within 3 weeks. The Summary of Take report is described in Appendix E and will include the following items related to adaptive management (in addition to other reporting requirements):

- Direct Take estimate;
- Direct Take projection;
- Calculation of the BFR and comparison of BFR to TV; and
- Comparison of BFR to tier based rates.

2.2 Semi-Annual Evaluations

HCP Compliance Report: Auwahi Wind summarizes the HCP compliance in a semi-annual report provided to USFWS and DOFAW in January each year. The semi-annual report will include the following items related to adaptive management (in addition to other reporting requirements):

- Direct Take estimate;
- Direct Take projection;
- Calculation of the BFR and comparison of BFR to TV; and
- Comparison of BFR to tier based rates.

2.3 Annual Evaluations

HCP Compliance Report: Auwahi Wind summarizes HCP compliance in an annual report provided to USFWS and DOFAW in August each year. In an annual meeting, Auwahi Wind reviews the HCP compliance status summary and take estimate projections with USFWS and DOFAW. The annual reports will include the following items related to adaptive management (in addition to other reporting requirements):

- Direct Take estimate;
- Direct Take projection;
- Calculation of the BFR and comparison of BFR to TV;
- Comparison of BFR to tier based rates; and,
- Adaptive management actions triggered or taken during the reporting year.

AMP Review: The AMP is intended to be a living document and will be updated as new information becomes available. Auwahi Wind will review the current AMP during the annual meeting with USFWS and DOFAW. Prior to the annual meeting, Auwahi Wind will review and summarize new literature relating to the development and effectiveness of minimization measures for the Hawaiian hoary bat and similar bat species. Literature to be reviewed includes: site-specific data, peer-reviewed literature, annual reports, industry publications, literature recommended by USFWS and DOFAW, or other sources. If Auwahi Wind determines, in consultation with USFWS and DOFAW, that new minimization measures are applicable and likely to be an improvement over those currently implemented or proposed in the AMP, the AMP will be updated to include the new measures and provided to the agencies for approval.

2.4 Scheduled Evaluations

Adaptive Management Action Review: Auwahi Wind will evaluate the PCMM data from the start of monitoring through December 31 of the preceding year (the most recent complete calendar year) to calculate the BFR using EoA in years 2020, 2025, and 2030. Auwahi Wind will then compare the BFR to the TV.

- If the BFR exceeds the TV, adaptive management actions, as described in Section 3 of the Interim AMP, will be implemented no later than March 31. See Follow-up Evaluation below.
- If the BFR does not exceed the TV, no action will be required.

Should a projection predict that the Project will exceed the permitted take authorization between scheduled evaluations, Auwahi Wind, in coordination with USFWS and DOFAW, will determine if adaptive management actions are warranted.

Follow-up Evaluation: When adaptive management actions are implemented, the effectiveness of the actions will be assessed after two years using PCMM data. At that time, the BFR will be compared to the TV to determine if additional adaptive management actions are warranted. Should the BFR exceed the TV at that time, adaptive management actions will be implemented as described in Section 3 of the Interim AMP, and the BFR will be re-evaluated again at 2-year intervals until the BFR is equal to or less than the TV. Should adaptive management actions be implemented less than 2 years from a scheduled evaluation year (2025 or 2030), the next evaluation will occur 2 years after the adaptive management actions instead of at the scheduled evaluation.

3.0 Adaptive Management Actions

Auwahi Wind has identified initial adaptive management actions based on understanding of Hawaiian hoary bat life history, PCMM, observations at the site, peer reviewed literature, and preliminary results of nacelle-level acoustic and thermal imagery studies conducted in 2018 and 2019. These findings demonstrate:

1. The majority of bat activity occurs in the first 6 hours of the night.
2. The months of May through October represent the highest continuous months of observed fatalities.
3. The geographic distribution of fatalities shows Turbines 1-4 have a higher proportion of observed fatalities than Turbines 5-8.

Adaptive management actions will be required if, at a Scheduled Evaluation or Follow-up Evaluation, the BFR exceeds the TV. If adaptive management actions are required, Auwahi Wind will implement adaptive management actions in the order listed below.

1. Temporal redistribution of curtailment nights: Curtailment at 6.9 m/s would be continued for the first 6 hours of the night for the months of August through October. Cut-in speeds for the remaining hours of the night would be 5.0 m/s. This would provide an additional 704 Curtailment Nights (see definition in Section 7.4.1.1 of the HCP Amendment), with cut-in speeds of 6.9 m/s for the first 6 hours of the night, to be redistributed. These additional Curtailment Nights would be applied May 5 through July 31 to address the intermediate risk months.
2. Spatial redistribution of curtailment nights: A higher proportion of fatalities have been observed at turbines 1-4 than at turbines 5-8. Redistribution of curtailment nights from turbines 5-8 to turbines 1-4 would be the second adaptive management action. The redistribution will allocate Curtailment Nights from turbines 5-8 from May 5 through July 31 to turbines 1-4 either nightly or seasonally. Selection of nightly or seasonal application would be based on post construction monitoring results following the implementation of the redistribution described above in action 1.
3. Should a redistribution of curtailment nights not provide sufficient minimization to keep the Project within the total take authorization, Auwahi Wind will implement an acoustic deterrent system or an alternative minimization technology (provided they are commercially available, demonstrated to be effective in Hawai'i, and determined not to negatively impact other wildlife).

4.0 Adaptive Management of Baseline Minimization

The suite of minimization measures available to reduce the risk to bats may change over time because of ongoing industry research and development of new technology. Auwahi Wind may propose a change to baseline minimization measures identified in the HCP Amendment (Section 4.2.7) or adaptive management actions in the AMP, such as replacement of low wind speed curtailment with bat deterrent technology. Such a change would be subject to review and approval by USFWS and DOFAW prior to being implemented at the Project.

State of Hawai'i
Department of Land and Natural Resources
Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu, Hawai'i 96813

Incidental Take License Number: ITL-17 Amended on XXXX
Date of Issue: Feb 9, 2012
Valid Until: 25 years from date of issue

INCIDENTAL TAKE LICENSE

To accompany:

"Auwahi Wind Farm Project Habitat Conservation Plan"

The Board of Land and Natural Resources hereby grants permission under the authority of Hawaii Revised Statutes §§ 195D-4(g) and 195D-21 and all other applicable laws to:

Auwahi Wind Energy, LLC

For take, if such taking is incidental to and not the purpose of the carrying out of an otherwise lawful activity, of the following species:

Common Name	Scientific Name	Tier	Requested Authorization^	TMK
'Ua'u (Hawaiian petrel)	*Pterodroma sandwichensis*	Tier 1	19 adults/ immatures and 7 chicks/eggs	TMKs 1-9-001:006,
		Tier2	32 adults/ immatures and 12 chicks/eggs	
		Tier 3	64 adults/ immatures and 23 chicks/eggs	
Nene	*Branta sandvicensis*	Length of permit	5 adults/ immatures and fledglings	
'Ope'ape'a (Hawaiian hoary bat)	*Lasiurus cinereus semotus*	Tier 1	5 bats	
		Tier2	11 bats	
		Tier 3	21 bats	
		Tier 4	81 bats	
		Tier 5	115 bats	
		Tier 6	140 bats	

Common Name	Scientific Name	Tier	Requested Authorization^	TMK
Blackburn's sphinx moth	*Manduca blackburni*	Not applicable	28-acres permanently disturbed habitat covered*	

^Requested Authorization numbers for tiers are cumulative.
*Where the acres of permanently disturbed habitat is an index of take.

I. GENERAL CONDITIONS

1. This license only authorizes incidental take of the covered species by the licensee on the lands owned or otherwise controlled by Auwahi Wind Energy, LLC, on the island of Maui, Hawai'i at the time this license is issued pursuant to the "Auwahi Wind Farm Project Habitat Conservation Plan" dated January, 2012 (hereafter "HCP") as revised by the HCP Amendment dated July 2019.

2. This license is valid only if Auwahi Wind Energy, LLC abides by the terms and conditions of the HCP and ITL for the duration of the permit.

3. This license is valid for species protected by federal law only if accompanied by valid federal Incidental Take Permit or Biological Opinion.

4. This license shall become valid upon completion of the following:
    i. A legal representative of Auwahi Wind Energy, LLC has acknowledged understanding and agreement to abide by its conditions by signing two copies of this license.
    ii. Both copies of the signed license must be returned to the Division of Forestry and Wildlife. Upon approval by the Chairperson, a copy of the license will be returned to the applicant.

5. The Board may suspend or revoke this license if the HCP is suspended or revoked. The Board may also suspend or revoke this license in accordance with applicable laws and regulations in force during the term of the license.

II. SPECIAL CONDITIONS

1. The allowable incidental take authorized by this license for the covered species includes observed, unobserved, direct and indirect take as defined in the HCP.

2. The estimation of incidental take for the covered species will be calculated according to adjustments made to the observed direct take according to methods detailed in the HCP, including but not limited to adjustments to include unobserved and indirect take.

3. DLNR will be notified within 3 days of any mortalities, injuries, or disease related to the covered species observed on the property. Injured individuals or carcasses will be handled according to guidelines in the HCP.

Approved by the Board of Land and Natural Resources at its meeting held on August 23, 2019.

By:______________________________ Date ______________

Suzanne D. Case, Chairperson and Member
Board of Land and Natural Resources

The undersigned has read, understands, and hereby agrees to abide by the General Conditions and the Special Conditions stipulated in this license.

Auwahi Wind Energy, LLC

By:______________________________ Date ______________

Its: ______________________________

Auwahi Wind Energy, LLC's notarized signature is made a part of this document.

NOTARY ON NEXT PAGE

Cc: DOFAW
DOCARE
USFWS Pacific Islands Office, Honolulu

Auwahi Wind Draft HCP Amendment
Public Comments during the HCP State public comment period published in OEQC Dec 23, 2018 - Feb 21, 2019

Name	*Date of Comment*	*Summary of Comments Provided*	*Response*	*Notes*
Randy Conrads	12/21/2018	1. Request additional information regarding the loss of electricity proposed with operational changes related to LWSC.	The HCP includes data on monthly average wind speed in Section 3.8.1.3. Energy production data is proprietary.	
Randy Conrads	12/21/2018	2. Request location of the Draft EIS.	N/A	
Randy Conrads	12/21/2018	3. Estimates that $750,000 lost and 1,000 tons of gas put into the atmosphere per bat saved.	AWEA has provided a general assessment of the carbon offset of the wind industry at: https://www.awea.org/wind-101/benefits-of-wind/environmental-benefits	
Christopher Carafino	12/15/2018	1. "Some study should have been undertaken or should be noted for future projects to determine if native Hawaiian birds and bats use a consistent flight path lane where wind turbines may be erected."	Preconstruction surveys are described in the approved HCP. Additional, pre-construction surveys are outside of the scope of this analysis.	
Christopher Carafino	12/15/2018	2. I am also curious if the Hawaiian bats are dying in higher numbers during certain months or seasons than any other times and if the bats are striking all the turbines or only a specific area of turbines?	The known information on fatalities is described in Section 3.8.1.3 of the HCP amendment and documented in annual reports.	
Christopher Carafino	12/15/2018	3. Thermal imagery to monitor for bats should be included as a permit condition.	PCMM is described in Section 7.1. Additional monitoring including thermal imagery is described in Section 7.4.1.2.	
Christopher Carafino	12/15/2018	4. The acoustic bat deterrent may have detrimental effects on other species.	The impact of acoustic deterrents on other species has not been documented. The potential impacts of acoustic deterrents on other species is continuing to be assessed as deterrents are tested.	
Christopher Carafino	12/15/2018	5. "I am also concerned with the wind farms projected fatality estimation decreasing as time goes on, as one may believe the longer the blades spin, the more bats die, the likelihood of the Hawaiian bat population decreases to extinction. "	The available information on the Hawaiian hoary bat "points to a species that is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources" as described the USFWS. Although there are certain aspects of the Hawaiian hoary bat ecology that are not fully understood, the available data provides sufficient information to determine that the project is unlikely to have population impacts. The discussion of the impacts to the bat population in Section 5.1.3.1 and 5.1.3.2 has been revised based on input from USFWS, DOFAW, and the ESRC.	
Janna Swanson	1/22/2019	1. Concerned about impacts of wind in Iowa and the MidAmerican HCP.	Impacts of facilities in other states is outside of the scope of the analysis of the HCP.	
Janna Swanson	1/22/2019	2. "Please ask the wind companies how much CO2 is being avoided with industrial wind. "	AWEA has provided a general assessment of the carbon offset of the wind industry at: https://www.awea.org/wind-101/benefits-of-wind/environmental-benefits	
Janna Swanson	1/22/2019	3. Concerned that "industrial wind is not the right direction".	Impacts of facilities in other states and the wind industry overall is outside of the scope of the analysis of the HCP.	
Keahi Bustamente	2/15/2019	1. I disapprove of the change to increase the take mostly because there's too many unknowns.	The available information on the Hawaiian hoary bat "points to a species that is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources" as described the USFWS. Although there are certain aspects of the Hawaiian hoary bat ecology that are not fully understood, the available data provides sufficient information to determine that the project is unlikely to have population impacts. The discussion of the impacts to the bat population in Section 5.1.3.1 and 5.1.3.2 has been revised based on input from USFWS, DOFAW, and ESRC.	Public Hearing
Cody Tuiventi	2/15/2019	2. Does not believe that LWSC is likely to reduce the take rate.	The efficacy of LWSC is discussed in Section 4.2.7 of the HCP Amendment.	Public Hearing
Cody Tuiventi	2/15/2019	3. It is unknown how many bats remain	The available information on the Hawaiian hoary bat "points to a species that is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources" as described the USFWS. Although there are certain aspects of the Hawaiian hoary bat ecology that are not fully understood, the available data provides sufficient information to determine that the project is unlikely to have population impacts. The discussion of the impacts to the bat population in Section 5.1.3.1 and 5.1.3.2 has been revised based on input from USFWS, DOFAW, and ESRC.	Public Hearing
Cody Tuiventi	2/15/2019	4. Views the removal of native plants as take.	The HCP Amendment does not propose take of native plant species.	Public Hearing
Kaniloa Kamaunu	2/15/2019	5. The land and species are family to native Hawaiians and take impacts family.	The cultural impacts of the HCP are described in the SEIS and PEIS.	Public Hearing

Auwahi Wind Draft HCP Amendment
Public Comments during the HCP State public comment period published in OEQC Dec 23, 2018 - Feb 21, 2019

Name	*Date of Comment*	*Summary of Comments Provided*	*Response*	*Notes*
Kaniloa Kamaunu	2/15/2019	6. Requesting a high take amount because there is insufficient information.	The take estimates are based on 5 years of project specific monitoring and a review of the best available science to predict the effects of minimization measures.	Public Hearing
Kaniloa Kamaunu	2/15/2019	7. Suggest mitigation for all take that has occurred prior to requesting an amendment.	Mitigation for all take proposed in the HCP and HCP Amendment is outlined in Section 6 of the HCP Amendment. Mitigation will fully offset and provide a net benefit for the species.	Public Hearing
Kaniloa Kamaunu	2/15/2019	8. Suggests there is insufficient information about the Hawaiian hoary bat	The available information on the Hawaiian hoary bat "points to a species that is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources" as described the USFWS. Although there are certain aspects of the Hawaiian hoary bat ecology that are not fully understood, the available data provides sufficient information to determine that the project is unlikely to have population impacts. The discussion of the impacts to the bat population in Section 5.1.3.1 and 5.1.3.2 has been revised based on input from USFWS, DOFAW, and ESRC.	Public Hearing
Keoki Raymond	2/15/2019	9. Suggests the term take should be replaced with the term kill	Take is defined by the ESA and HRS-195D.	Public Hearing
Keoki Raymond	2/15/2019	10. Opposes wind energy	Preferences regarding the HCP Amendment are noted for consideration but do not warrant revisions to the HCP Amendment.	Public Hearing
Keoki Raymond	2/15/2019	11. "jacking up the numbers of take.. is not achieving anything other than just justifying these guys... killing more animals and it's wrong."	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Public Hearing
Brad Yuen	2/15/2019	12. I am concerned for the species, that's the reason why I want to do research on the species.	The Project also shares concern for the species as indicated by the minimization measures and mitigation described in the HCP. Compliance with HRS and ESA result in a benefit to the species, despite incidental take.	Public Hearing
Brad Yuen	2/15/2019	13. bats also produce drinking buzzes that look something like feeding buzzes, but actually are different when they're drinking on the wing.	The HCP amendment is updated to incorporate all calls into the analysis of impacts for Tier 4. Differentiating drinking and feeding buzzes may be a means of differentiating the impacts of management actions but is subject to analysis of collected data.	Public Hearing
Kekaula Campbell	2/15/2019	14. Requests discussion of cultural significance in the HCP amendment	The cultural impacts of the HCP are described in the SEIS and PEIS.	Public Hearing
Kekaula Campbell	2/15/2019	15. "you can take the bat and then it's gone and then it's gone forever."	The available information on the Hawaiian hoary bat "points to a species that is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources" as described the USFWS. Although there are certain aspects of the Hawaiian hoary bat ecology that are not fully understood, the available data provides sufficient information to determine that the project is unlikely to have population impacts. The discussion of the impacts to the bat population in Section 5.1.3.1 and 5.1.3.2 has been revised based on input from USFWS, DOFAW, and ESRC.	Public Hearing
Kekaula Campbell	2/15/2019	16. "And you can always turn off the wind farm, you know, you can always turn off -- turn them off at night, cut the wind speed down, you know, learn more about the bat."	This alternative was considered in Section 8.3 of the HCP Amendment.	Public Hearing
Kekaula Campbell	2/15/2019	17. "if they're not going to be held accountable for the first 5 years and the mistakes they made already, what's to stop them in the future from just adding tiers, making more amendments, and just taking all the native species out of existence?"	Mitigation for all take proposed in the HCP and HCP Amendment is outlined in Section 6 of the HCP Amendment. Mitigation will fully offset and provide a net benefit for the species.	Public Hearing
Kekaula Campbell	2/15/2019	18. Suggests the process does not comply with the ESA.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Public Hearing
Kekaula Campbell	2/15/2019	19. Opposes all amendments	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Public Hearing
John Comwich	2/15/2019	20. Need to reduce the dependence on oil and coal.	This is recognized as an important driver for the Project being constructed.	Public Hearing
John Comwich	2/15/2019	21. Wind farms are an eyesore but supply energy locally	This is recognized as an important driver for the Project being constructed.	Public Hearing

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Name	*Date of Comment*	*Summary of Comments Provided*	*Response*	*Notes*
John Comwich	2/15/2019	22. Mitigation provides benefits to covered species as well as other species	The benefits of mitigation are outlined in Section 6.2.4 and 6.2.5.	Public Hearing
John Comwich	2/15/2019	23. The HCP Amendment is a "Win-win", producing green energy and restoring pasture land	Preferences regarding the HCP Amendment are noted for consideration but do not warrant revisions to the HCP Amendment.	Public Hearing
Laura Berthold	2/15/2019	24. We are not quantifying the impacts of climate change to the species	This is more appropriate discussion for the PEIS.	Public Hearing
Laura Berthold	2/15/2019	25. There is a need for local and green energy	This is recognized as an important driver for the Project being constructed.	Public Hearing
Laura Berthold	2/15/2019	26. In addition to the climate benefits the habitat restoration will benefit many species.	The benefits of mitigation are outlined in Section 6.2.4 and 6.2.5.	Public Hearing
Hanna Mounce	2/15/2019	27. Many things go un-mitigated so mitigation is increasingly important. The mitigation already implemented by Auwahi Wind will benefit many species	The benefits of mitigation are outlined in Section 6.2.4 and 6.2.5.	Public Hearing
Hanna Mounce	2/15/2019	28. The inability to quantify the impacts to bats means the impacts of mitigation is uncertain.	The uncertainty of mitigation is addressed in Section 6.2.4.3. The success criteria for mitigation focus on increasing bat activity as monitored through acoustic activity at the mitigation site. Although there is uncertainty about the scale of impacts of the mitigation, mitigation for Tier 1 has been shown to increase bat activity. Additionally, the activity of bats in the area is higher than anticipated. The Project is using the industry standard for monitoring of solitary tree roosting bat species, which is the best information available.	Public Hearing
Hanna Mounce	2/15/2019	29. We don't know that the bat population can withstand the additional take requested, thus it would be irresponsible to increase their take.	The available information on the Hawaiian hoary bat "points to a species that is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources" as described the USFWS. Although there are certain aspects of the Hawaiian hoary bat ecology that are not fully understood, the available data provides sufficient information to determine that the project is unlikely to have population impacts. The discussion of the impacts to the bat population in Section 5.1.3.1 and 5.1.3.2 has been revised based on input from USFWS, DOFAW, and ESRC.	Public Hearing
Laura Berthold	2/21/2019	1. The take of 7 bats per year would not lead to a decline in the bat population.	The available information on the Hawaiian hoary bat "points to a species that is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources" as described the USFWS. Although there are certain aspects of the Hawaiian hoary bat ecology that are not fully understood, the available data provides sufficient information to determine that the project is unlikely to have population impacts. The discussion of the impacts to the bat population in Section 5.1.3.1 and 5.1.3.2 has been revised based on input from USFWS, DOFAW, and ESRC.	
Laura Berthold	2/21/2019	2. Mitigation and mitigation monitoring are essential and included in the HCP Amendment.	The benefit of mitigation and monitoring are incorporated in the HCP amendment Section 6.2.4. This comment does not alter the HCP Amendment.	
Laura Berthold	2/21/2019	3. Suggest supplemental feeding in the mitigation area prior to forest establishment.	The Project appreciates the description of supplemental feeding as an alternative mitigation measure. This method of mitigation is incorporated through the development of water features. Other methods for implementing supplemental feeding have not been documented for aerial hawking insectivorous bats, but may be evaluated.	
Laura Berthold	2/21/2019	4. Drowning in troughs has been documented in other avian species	Wildlife egress structures are suggested in Section 6.2.4.2	
Laura Berthold	2/21/2019	5. The estimate of population and the estimates for mitigation offset are inconsistent metrics	Substantial revision to the impacts to bat population, Section 5.1.3.1 and Section 5.1.3.2 have incorporated updates that include ranges for estimates and use the same metrics identified in the mitigation.	
Laura Berthold	2/21/2019	6. "If any technology comes up that would better or additionally deter than slowing down the blade, then that should be implemented."	The installation of deterrents is addressed in the HCP Amendment, Section 7.4.1.4 "Future Technologies". The project will continue to monitor the status and viability of commercially available bat deterrents.	
Laura Berthold	2/21/2019	7. There is a lack of public awareness of bats, energy, and the wind industry	This comment is outside of the scope of the analysis for the HCP amendment.	

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Krystal Vasquez	1/31/2019	1. "Please stop killing these bats"	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	No project or document identified
Diana Crow	2/21/2019	1. "I am writing in support of the Auwahi Wind HCP Amendment."	Preferences regarding the HCP Amendment are noted for consideration but do not warrant revisions to the HCP Amendment.	
Diana Crow	2/21/2019	2. There are negative consequences to native species from not using renewable energy	This is more appropriate discussion for the PEIS.	
Diana Crow	2/21/2019	3. Wind energy is an important to meet Maui energy needs.	This is recognized as an important driver for the Project being constructed.	
Diana Crow	2/21/2019	4. Bat deterrents are likely to be available soon.	The installation of deterrents is addressed in the HCP Amendment, Section 7.4.1.4 "Future Technologies". The project will continue to monitor the status and viability of commercially available bat deterrents.	
Diana Crow	2/21/2019	5. The risk of the project is small compared to the land area of Maui.	The available information on the Hawaiian hoary bat "points to a species that is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources" as described the USFWS. Although there are certain aspects of the Hawaiian hoary bat ecology that are not fully understood, the available data provides sufficient information to determine that the project is unlikely to have population impacts. The discussion of the impacts to the bat population in Section 5.1.3.1 and 5.1.3.2 has been revised based on input from USFWS, DOFAW, and ESRC.	
Diana Crow	2/21/2019	6. The mitigation will benefit a multitude of native species of plants, birds, and insects in addition to the bats.	The benefits of mitigation are outlined in Section 6.2.4 and 6.2.5.	
Diana Crow	2/21/2019	7. The research conducted by Auwahi helps Hawaii know more about bats.	The benefit of research is important for the species as outlined by the USFWS Hawaiian Hoary Bat Recovery Plan and the DOFAW Hawaiian Hoary Bat Guidance Document. This comment does not alter the HCP Amendment.	
Hanna Mounce	NA	1. "There is no evidence that the current HCP for Auwahi Wind has provided a net benefit to the population."	The uncertainty of mitigation is addressed in Section 6.2.4.3. The success criteria for mitigation focus on increasing bat activity as monitored through acoustic activity at the mitigation site. Although there is uncertainty about the scale of impacts of the mitigation, mitigation for Tier 1 has been shown to increase bat activity. Additionally, the activity of bats in the area is higher than anticipated. The Project is using the industry standard for monitoring of solitary tree roosting bat species, which is the best information available.	Written comment from Public hearing
Hanna Mounce	NA	2. "To allow additional take when we have no proven mitigation success and no idea what proportion of population we are killing is grossly irresponsible."	The available information on the Hawaiian hoary bat "points to a species that is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources" as described the USFWS. Although there are certain aspects of the Hawaiian hoary bat ecology that are not fully understood, the available data provides sufficient information to determine that the project is unlikely to have population impacts. The discussion of the impacts to the bat population in Section 5.1.3.1 and 5.1.3.2 has been revised based on input from USFWS, DOFAW, and ESRC.	Written comment from Public hearing
Tristen See	NA	1. Oppose the increase in incidental take authorization.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Written comment from Public hearing
Tristen See	NA	2. Suggest the process does not comply with the ESA.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Written comment from Public hearing
Tristen See	NA	3. "This could create irrepairrable harm to 'ope'ape'a population (a) and to the food chain, insect populations, etc., that is difficult to predict(b).	The available information on the Hawaiian hoary bat "points to a species that is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources" as described the USFWS. Although there are certain aspects of the Hawaiian hoary bat ecology that are not fully understood, the available data provides sufficient information to determine that the project is unlikely to have population impacts. The discussion of the impacts to the bat population in Section 5.1.3.1 and 5.1.3.2 has been revised based on input from USFWS, DOFAW, and ESRC.	Written comment from Public hearing

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Jayne Kanoholam(spelling? Writing illegible)	NA	1. Oppose the increase in incidental take authorization.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Written comment from Public hearing
Jayne Kanoholam (spelling? Writing illegible)	NA	2. The Hawaiian hoary bat is culturally significant	The cultural impacts of the HCP are described in the SEIS and PEIS.	Written comment from Public hearing
Kosianya Mosi (spelling? Writing illegible)	NA	1. Oppose the increase in incidental take authorization.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Written comment from Public hearing
Alexis Rosete	NA	1. Oppose the increase in incidental take authorization.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Written comment from Public hearing
Jordan Holokai-Jacinto	NA	1. Oppose the increase in incidental take authorization.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Written comment from Public hearing
Makana Gomes	NA	1. Oppose the increase in incidental take authorization.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Written comment from Public hearing
Makana Gomes	NA	2. The Hawaiian hoary bat is culturally significant	The cultural impacts of the HCP are described in the SEIS and PEIS.	Written comment from Public hearing
Eli Reinhardt	NA	1. Oppose the increase in incidental take authorization.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Written comment from Public hearing
Seth Navas	NA	1. Oppose the increase in incidental take authorization.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Written comment from Public hearing
Jade HK	NA	1. Oppose the increase in incidental take authorization.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Written comment from Public hearing
Makana Remilla	NA	1. "I am not in favor of the mitigation efforts that have been put in place"	Opposition to prior approved mitigation is outside of the scope of this analysis. Opposition to mitigation proposed in the HCP amendment cannot be incorporated without specific concerns to address.	Written comment from Public hearing
Brandon Sado	NA	1. Oppose the increase in incidental take authorization.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Written comment from Public hearing
Joel Curcio	NA	1. "Solar isn't killing bats, so you don't have too!"	The project is already developed, therefore alternate project specifications are outside of the scope of this analysis.	Written comment from Public hearing
Tehilles (Spelling? Writing illegible)	NA	1. Oppose the increase in incidental take authorization.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Written comment from Public hearing
Shayra Mae Dodoit-Cabon (Spelling?)	NA	1. Oppose the increase in incidental take authorization.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Written comment from Public hearing
Linernlu Patniy (Spelling?)	NA	1. Oppose the increase in incidental take authorization.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	Written comment from Public hearing
Judy Buettner	2/19/2019	1. "Does anyone know how many Hi bats exist now? What if allowing more deaths puts them over the edge for extinction? "	The available information on the Hawaiian hoary bat "points to a species that is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources" as described the USFWS. Although there are certain aspects of the Hawaiian hoary bat ecology that are not fully understood, the available data provides sufficient information to determine that the project is unlikely to have population impacts. The discussion of the impacts to the bat population in Section 5.1.3.1 and 5.1.3.2 has been revised based on input from USFWS, DOFAW, and ESRC.	
Judy Buettner	2/19/2019	2. Are there permit limits for other species of the HCP?	The approved HCP provides a comprehensive list of species covered by the HCP, including plants and animals in Section 3.8. The HCP Amendment only addresses the changes from the original HCP.	
Judy Buettner	2/19/2019	3. Oppose the increase in incidental take authorization.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	

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Judy Buettner	2/19/2019	4. "What is the point of having something on the endangered list and still being able to kill it?"	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	
Joe Herzog	2/8/2019	1. "I hope the wind farms and the DLNR will do all they can to reduce the "take" of our flying wildlife"	Minimization to the Maximum Extent Practicable is described in Section 4.2.7 and Section 8 of the HCP Amendment.	
Joe Herzog	2/8/2019	2. "As I have written in the past, the killing of bats and Nene disqualifies wind farms as producers of "clean energy.""	The characterization of the project as 'clean energy' is not the focus of the HCP amendment and will therefore not be addressed.	
Joe Herzog	2/8/2019	3. "I hope that the wind farms will do more than the minimum to protect the birds and bats that are looking for airspace that won't kill them."	Minimization to the Maximum Extent Practicable is described in Section 4.2.7 and Section 8 of the HCP Amendment. The benefits of mitigation are outlined in Section 6.2.4 and 6.2.5	
Joe Herzog	2/8/2019	4. "Corporate donations of money for land to preserve bat habitat is wonderful [a], but not when it is done so that more bats can be killed by the wind turbines[b]."	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	
Erin Starr	12/27/2018	1. "The wind farms should turn off before dusk and during the night, while the bats feed."	This alternative was considered in Section 8.3 of the HCP Amendment.	No project or document specified
Joe Imhoff	2/21/2019	1. The total population estimate of ʻopeʻapeʻa is unknown.	The available information on the Hawaiian hoary bat "points to a species that is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources" as described the USFWS. Although there are certain aspects of the Hawaiian hoary bat ecology that are not fully understood, the available data provides sufficient information to determine that the project is unlikely to have population impacts. The discussion of the impacts to the bat population in Section 5.1.3.1 and 5.1.3.2 has been revised based on input from USFWS, DOFAW, and ESRC.	
Joe Imhoff	2/21/2019	2. The original estimate of "take" was drastically miscalculated.	The take estimates are based on 5 years of project specific monitoring and a review of the best available science to predict the impacts of minimization measures.	
Joe Imhoff	2/21/2019	3. The breakdown of mitigation money that is provided by the private company to increase the population of bats was not communicated at the public hearing.	The public hearing was held by the Division of Forestry and Wildlife. Auwahi Wind has made the Draft HCP amendment available to the public through publication in the OEQC.	
Joe Imhoff	2/21/2019	4. The mitigation money increase due to the "take" increase request was not communicated at the public hearing.	The public hearing was held by the Division of Forestry and Wildlife. Auwahi Wind has made the Draft HCP amendment available to the public through publication in the OEQC.	
Joe Imhoff	2/21/2019	5. The proximity of the in-house mitigation site is less than 5 miles distance to the windmills. It is unknown if this is too close and could pose as a danger for the potential new population of ʻopeʻapeʻa .	The mitigation site selection criteria are described in Section 6.2.4.1.	
Joe Imhoff	2/21/2019	6. It is unknown if mitigation efforts to date have produced any new bats.	The uncertainty of mitigation is addressed in Section 6.2.4.3. The success criteria for mitigation focus on increasing bat activity as monitored through acoustic activity at the mitigation site. Although there is uncertainty about the scale of impacts of the mitigation, mitigation for Tier 1 has been shown to increase bat activity. Additionally, the activity of bats in the area is higher than anticipated. The Project is using the industry standard for monitoring of solitary tree roosting bat species, which is the best information available.	
Joe Imhoff	2/21/2019	7. it is unknown if the plants that have been installed are increasing native insect populations for ʻopeʻapeʻa to feed.	The uncertainty of mitigation is addressed in Section 6.2.4.3. The success criteria for mitigation focus on increasing bat activity as monitored through acoustic activity at the mitigation site. Although there is uncertainty about the scale of impacts of the mitigation, mitigation for Tier 1 has been shown to increase bat activity. Additionally, the activity of bats in the area is higher than anticipated. The Project is using the industry standard for monitoring of solitary tree roosting bat species, which is the best information available.	

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Joe Imhoff	2/21/2019	8. it is unknown if increasing the “take” will wipe out the localized population of ‘?pe‘ape‘a completely.	The available information on the Hawaiian hoary bat "points to a species that is well adapted to a range of environments and resilient to small-scale changes in habitat condition and available resources" as described the USFWS. Although there are certain aspects of the Hawaiian hoary bat ecology that are not fully understood, the available data provides sufficient information to determine that the project is unlikely to have population impacts. The discussion of the impacts to the bat population in Section 5.1.3.1 and 5.1.3.2 has been revised based on input from USFWS, DOFAW, and ESRC.	
Joe Imhoff	2/21/2019	9. it is unknown if current and proposed mitigation efforts will prove to be enough to assure a net benefit by effectively increasing population density of ‘?pe‘ape‘a .	The uncertainty of mitigation is addressed in Section 6.2.4.3. The success criteria for mitigation focus on increasing bat activity as monitored through acoustic activity at the mitigation site. Although there is uncertainty about the scale of impacts of the mitigation, mitigation for Tier 1 has been shown to increase bat activity. Additionally, the activity of bats in the area is higher than anticipated. The Project is using the industry standard for monitoring of solitary tree roosting bat species, which is the best information available.	
Joe Imhoff	2/21/2019	10. It is unknown if increasing the "take" of this endangered species would set a dangerous precedent for other private companies to be allowed to "take" an endangered species with so many unknown variables.	The take license process is provided by HRS 195D, review of the process is outside of the scope of the HCP Amendment.	