

## Appendix E.

**BIOLOGICAL RESOURCES SURVEY**

**for the**

**NORTH SHORE WIND POWER PROJECT**

**KAHUKU, KO'OLAULOA, HAWAI'I**

**by**

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April 2007**

**Prepared for:  
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## INTRODUCTION

The North Shore Wind Power Project is located on the northern tip of O'ahu on 506 acres of land at Kahuku, Ko'olaupia (TMK (1) 5-6-05:007). It is bounded on the east and south by pasture and agricultural lands along the Kamehameha Highway and bordering the town of Kahuku, on the north by undeveloped military reservation land and on the west by rough mountainous land. This survey was initiated to address environmental requirements of the planning process.

## SITE DESCRIPTION

This property is situated on a plateau above the coastal plain. The bluffs on the seaward edge of the plateau which stand at about 120 – 150 feet above sea level are made up of lithified sand from ancient coastal dunes which are now eroded and sculpted by the wind. The plateau itself is made up of soils of the Paumalu, Lahaina and Kaena series which are deep silty clays and clays (Foote et al, 1972). Inland the land slopes upward into hills and gullies to a maximum elevation of 535 feet. The vegetation is mostly dense brush and trees with an abundance of grass in the understory. Rainfall averages 45-50 inches per year with the bulk falling during the winter and spring months (Armstrong, 1983).

## BIOLOGICAL HISTORY

The original native vegetation would have been a combination of coastal and lowland windward forests of dense character. Dominating this vegetation would have been such species as 'a'ali'i (*Dodonaea viscosa*), 'ohi'a (*Metrosideros polymorpha*), u'ulei (*Osteomeles anthyllidifolia*), hala (*Pandanus tectorius*) and a great variety of other trees, shrubs, vines and ferns.

During several hundred years of Hawaiian occupation, much of the more fertile lands would have been utilized for agriculture with a variety of food and fiber crops. Most of the surrounding areas, however, would have remained essentially native in character all the way to the shoreline.

Late in the 1800's this area was farmed for sugar production and this use continued for about 100 years. During this period the land was repeatedly plowed, planted, irrigated and harvested. Native plant species were all but eliminated from the area. Since the demise of sugar this area has been used for cattle grazing up until the present. The land is low largely covered with dense brush and trees with grasses and herbaceous weeds in the openings. Only a handful of hardy native plant species persist.

## SURVEY OBJECTIVES

This report summarizes the findings of a flora and fauna inventory and assessment of the North Shore Wind Power Project area which was conducted in March 2007. The objectives of the survey were to:

1. Document what plant species occur on the property.
2. Document the status and abundance of each species.
3. Determine the presence or likely occurrence of any native flora and fauna, particularly any that are Federally listed as Endangered or Threatened. If such occur, identify what features of the habitat may be essential for these species.
4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the flora and fauna in this part of the island.

## FLORA SURVEY REPORT SURVEY METHODS

A walk-through botanical survey method was used following a series of routes to ensure maximum coverage of all parts of this large property. Areas most likely to harbor native or rare plants such as gullies or rocky outcrops were more intensively examined. Notes were made on plant species, distribution and abundance as well as terrain and substrate.

## DESCRIPTION OF THE VEGETATION

About 80% of this large property is covered with dense brush and trees. Smaller areas are more open with grasses and herbaceous species. A total of 128 plant species were recorded during the survey. Of these, all 13 of the abundant and common species were non-native plants. These were: sourgrass (*Digitaria insularis*), koa haole (*Leucaena leucocephala*), pitted beardgrass (*Bothriochloa pertusa*), Chinese violet (*Asystasia gangetica*), Christmas berry (*Schinus terebinthifolius*), parasol leaf tree (*Macaranga tanarius*), kolomona (*Senna surratensis*), common beggarticks (*Bidens alba*), sourbush (*Pluchea carolinensis*), allspice (*Pimenta dioeca*), lantana (*Lantana camara*), Jamaica vervain (*Stachytarpheta jamaicensis*) and pea aubergine (*Solanum torvum*).

Two endemic native species were found on the property: ni'ani'au (*Nephrolepis exaltata* subsp. *hawaiiensis*) and 'akia (*Wikstroemia oahuensis*). And additional

seven indigenous native species were found on the property as well: pala'ā (*Sphenomeris chinensis*), pi'i pi'i (*Chrysopogon aciculatus*), 'ala'alawainui (*Peperomia blanda* var. *floribunda*), u'ulei, 'ilie'e (*Plumbago zeylanica*), popolo (*Solanum americanum*) and 'uhaloa (*Waltheria indica*). Five Polynesian introductions were found: ki (*Cordyline fruticosa*), niu (*Cocos nucifera*), kukui (*Aleurites moluccana*), 'ihi'ai (*Oxalis corniculata*) and noni (*Morinda citrifolia*). The remaining 114 plant species were non-native pasture grasses, or ornamental or agricultural weeds.

## DISCUSSION AND RECOMMENDATIONS

The vegetation on this large property is largely non-native in character. The long history of agriculture and grazing has left little of the original native plants here. A few native species, 'ili'e'e, popolo and 'uhaloa, grow on the coral outcrops on the lower side of the property. A few others, ni'ani'au, 'akia, pala'ā, pi'ipi'i, u'ulei and 'ala'alawainui, grow on the exposed ridge tops near the top of the property. All of the native species are both widespread and common in Hawai'i due to their ability to withstand disturbance and cattle grazing.

No Threatened or Endangered plant species were found on this property, nor were any found that are candidates for such status. No special habitats or native plant assemblages of significance were found either that would warrant protection.

It is determined that the activities associated with the development of the proposed project would not result in significant negative impacts on the native vegetation in this part of O'ahu.

While not of any special importance it is suggested that some of the hardy native species that already occur on the property, such as the u'ulei, the 'akia and the 'ilie'e, might be considered for propagation and out planting to stabilize bank slopes along any constructed access roads within the project area.

## PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within each of four groups: Ferns, Conifers, Monocots and Dicots. Taxonomy and nomenclature of the ferns are in accordance with Palmer (2003). The conifers are in accordance with Krussman (1985). The flowering plants (Monocots and Dicots) are in accordance with Wagner et al. (1999).

For each species, the following information is provided:

1. Scientific name with author citation
2. Common English or Hawaiian name.
3. Bio-geographical status. The following symbols are used:
  - endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.
  - indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
  - polynesian = those plants brought to the islands by the Hawaiians during their migrations.
  - non-native = all those plants brought to the islands intentionally or accidentally after western contact.
4. Abundance of each species within the project area:
  - abundant = forming a major part of the vegetation within the project area.
  - common = widely scattered throughout the area or locally abundant within a portion of it.
  - uncommon = scattered sparsely throughout the area or occurring in a few small patches.
  - rare = only a few isolated individuals within the project area.

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<b>FERNS</b>			
LINDSAEACEAE (Lindsaea Family)			
<i>Sphenomeris chinensis</i> (L.) Maxon	pala'ā	indigenous	rare
NEPHROLEPIDACEAE (Sword Fern Family)			
<i>Nephrolepis exaltata</i> (L.) Schott subsp. hawaiiensis W.H.Wagner	ni'ani'au	endemic	rare
POLYPODIACEAE (Polypody Fern Family)			
<i>Phymatosorus grossus</i> (Langsd. & Fisch.) Brownlie	laua'e	non-native	rare
<b>CONIFERS</b>			
PINACEAE (Pine Family)			
<i>Pinus caribaea</i> Morelet	Caribbean pine	non-native	rare
<b>MONOCOTS</b>			
AGAVACEAE (Agave Family)			
<i>Agave sisalana</i> Perrine	sisal	non-native	rare
<i>Cordyline fruticosa</i> (L.) A. Chev.	ki	polynesian	rare
ARECACEAE (Palm Family)			
<i>Cocos nucifera</i> L.	niu	polynesian	rare
<i>Phoenix x dactylifera</i>	hybrid date palm	non-native	rare
CYPERACEAE (Sedge Family)			
<i>Cyperus rotundus</i> L.	nut-sedge	non-native	rare
POACEAE (Grass Family)			
<i>Andropogon virginicus</i> L.	broomsedge	non-native	rare
<i>Brachiaria mutica</i> (Forssk.) Stapf	California grass	non-native	rare
<i>Chloris barbata</i> (L.) Sw.	swollen fingergrass	non-native	rare
<i>Chloris divaricata</i> R.Br.	stargrass	non-native	uncommon
<i>Chrysopogon aciculatus</i> (Retz.) Trin.	pi'i pi'i	indigenous	uncommon

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<i>Cynodon dactylon</i> (L.) Pers.	Bermuda grass	non-native	uncommon
<i>Dactyloctenium aegyptium</i> (L.) Willd.	beach wiregrass	non-native	rare
<i>Digitaria ciliaris</i> (Retz.) Koeler	Henry's crabgrass	non-native	uncommon
<i>Digitaria insularis</i> (L.) Mez ex Ekman	sourgrass	non-native	abundant
<i>Eleusine indica</i> (L.) Gaertn.	wiregrass	non-native	uncommon
<i>Eragrostis amabilis</i> (L.) Wight & Arnott	Japanese lovegrass	non-native	rare
<i>Eragrostis pectinacea</i> (Michx.) Nees	Carolina lovegrass	non-native	rare
<i>Panicum maximum</i> Jacq.	Guinea grass	non-native	uncommon
<i>Paspalum conjugatum</i> Bergius	Hilo grass	non-native	rare
<i>Paspalum dilatatum</i> Poir.	Dallis grass	non-native	uncommon
<i>Paspalum fimbriatum</i> Kunth	Panama paspalum	non-native	rare
<b>DICOTS</b>			
ACANTHACEAE (Acanthus Family)			
<i>Asystasia gangetica</i> (L.) T.Anderson	Chinese violet	non-native	common
AMARANTHACEAE (Amaranth Family)			
<i>Achyranthes aspera</i> L.	chirchita	non-native	uncommon
<i>Alternanthera pungens</i> Kunth	khaki weed	non-native	rare
<i>Amaranthus spinosus</i> L.	spiny amaranth	non-native	uncommon
<i>Amaranthus viridis</i> L.	slender amaranth	non-native	rare
ANACARDIACEAE (Mango Family)			
<i>Magnifera indica</i> L.	mango	non-native	rare
<i>Schinus terebinthifolius</i> Raddi	Christmas berry	non-native	common
APIACEAE (Parsley Family)			
<i>Centella asiatica</i> (L.) Urb.	Asiatic pennywort	non-native	rare
<i>Ciclospermum leptophyllum</i> (Pers.) Sprague	fir-leaved celery	non-native	rare
ASTERACEAE (Sunflower Family)			

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<i>Acanthospermum australe</i> (Loefl.) Kuntze	spiny bur	non-native	rare
<i>Ageratum conyzoides</i> L.	maile hohono common	non-native	uncommon
<i>Bidens alba</i> (L.) DC	beggarticks	non-native	common
<i>Calyptracarpus vialis</i> Less.	straggler daisy	non-native	uncommon
<i>Conyza bonariensis</i> (L.) Cronquist	hairy horseweed	non-native	rare
<i>Crassocephalum crepidioides</i> (Benth.)S.Moore	red flower ragleaf	non-native	rare
<i>Cyanthillium cinereum</i> (L.) H. Rob.	little ironweed	non-native	rare
<i>Emilia fosbergii</i> Nicolson	red pualele	non-native	rare
<i>Pluchea carolinensis</i> (Jacq.) G.Don	sourbush	non-native	common
<i>Pluchea indica</i> (L.) Less.	Indian fleabane	non-native	rare
<i>Synedrella nodiflora</i> (L.) Gaertn.	nodeweed	non-native	rare
<i>Verbesina encelioides</i> (Cav.) Benth.&Hook.	golden crown-beard	non-native	rare
<i>Xanthium strumarium</i> L.	cocklebur	non-native	uncommon
<b>BIGNONIACEAE (Bignonia Family)</b>			
<i>Spathodea campanulata</i> P.Beauv.	African tulip tree	non-native	rare
<b>BORAGINACEAE (Borage Family)</b>			
<i>Heliotropium procumbens</i> Mill.	clasping heliotrope	non-native	rare
<b>BRASSICACEAE (Mustard Family)</b>			
<i>Lepidium virginicum</i> L.	peppergrass	non-native	rare
<b>CARICACEAE (Papaya Family)</b>			
<i>Carica papaya</i> L.	papaya	non-native	rare
<b>CASUARINACEAE (She-oak Family)</b>			
<i>Casuarina equisetifolia</i> Stickm.	common ironwood	non-native	uncommon
<b>CHENOPODIACEAE (Goosefoot Family)</b>			

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<i>Chenopodium murale</i> L.	'aheahea	non-native	rare
CONVOLVULACEAE (Morning Glory Family)			
<i>Ipomoea obscura</i> (L.) Ker-Gawl.	-----	non-native	rare
EUPHORBIACEAE (Spurge Family)			
<i>Aleurites moluccana</i> (L.) Willd.	kukui	polynesian	rare
<i>Chamaesyce hirta</i> (L.) Millsp.	hairy spurge	non-native	rare
<i>Chamaesyce hypericifolia</i> (L.) Millsp.	graceful spurge	non-native	rare
<i>Chamaesyce prostrata</i> (Aiton.) Small	prostrate spurge	non-native	rare
<i>Macaranga tanarius</i> (L.) Mull. Arg.	parasol leaf tree	non-native	common
<i>Phyllanthus debilis</i> Klein ex Willd.	niruri	non-native	uncommon
<i>Ricinus communis</i> L.	Castor bean	non-native	rare
FABACEAE (Pea Family)			
<i>Acacia confusa</i> Merr.	Formosa koa	non-native	rare
<i>Acacia farnesiana</i> (L.) Willd.	klu	non-native	uncommon
<i>Chamaecrista nictitans</i> (L.) Moench	partridge pea	non-native	uncommon
<i>Crotalaria incana</i> L.	fuzzy rattlepod	non-native	rare
<i>Crotalaria pallida</i> Aiton	smooth rattlepod	non-native	rare
<i>Crotalaria retusa</i> L.	rattleweed	non-native	rare
<i>Desmanthus pernambucanus</i> (L.) Thellung	slender mimosa	non-native	uncommon
<i>Desmodium incanum</i> DC.	ka'imi clover	non-native	uncommon
<i>Desmodium triflorum</i> (L.)	three-flowered beggarweed	non-native	rare
<i>Erythrina variegata</i> L.	tiger claw	non-native	rare
<i>Indigofera hendecaphylla</i> Jacq.	creeping indigo	non-native	rare
<i>Leucaena leucocephala</i> (Lam.) de Wit	koa haole	non-native	abundant
<i>Macroptilium lathyroides</i> (L.) Urb.	wild bean	non-native	rare
<i>Medicago lupulina</i> L.	black medick	non-native	rare

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<i>Mimosa pudica</i> L.	sensitive plant	non-native	uncommon
<i>Neonotonia wightii</i> (Wight&Arnott) Lackey	glycine	non-native	rare
<i>Samanea saman</i> (Jacq.) Merr.	monkeypod	non-native	rare
<i>Senna occidentalis</i> (L.) Link	coffee senna	non-native	uncommon
<i>Senna surratensis</i> (N.L.Burm.)H.Irwin&Barneby	kolomona shrubby pencilflower	non-native	common
<i>Stylosanthes fruticosa</i> (Retz.) Alston		non-native	uncommon
<b>LAMIACEAE (Mint Family)</b>			
<i>Leonotis nepetifolia</i> (L.) R.Br.	lion's ear	non-native	uncommon
<i>Ocimum gratissimum</i> L.	wild basil	non-native	rare
<b>MALVACEAE (Mallow Family)</b>			
<i>Abutilon grandifolium</i> (Willd.) Sweet	hairy abutilon	non-native	rare
<i>Malva parviflora</i> L.	cheeseweed	non-native	rare
<i>Malvastrum coromandelianum</i> (L.) Garcke.	false mallow	non-native	uncommon
<i>Sida ciliaris</i> (L.) D.Don	fringed fan petals	non-native	uncommon
<i>Sida rhombifolia</i> L.	Cuban jute	non-native	uncommon
<i>Sida spinosa</i> L.	prickly sida	non-native	uncommon
<b>MELASTOMATACEAE (Melastoma Family)</b>			
<i>Clidemia hirta</i> (L.) D.Don	Koster's curse	non-native	rare
<b>MORACEAE (Fig Family)</b>			
<i>Ficus macrophylla</i> Desf. ex Pers.	Moreton Bay fig	non-native	rare
<i>Ficus microcarpa</i> L.fil.	Chinese banyan	non-native	rare
<i>Ficus platypoda</i> A.Cunn.ex Miq.	rock fig	non-native	uncommon
<b>MYRSINACEAE (Myrsine Family)</b>			
<i>Ardisia elliptica</i> Thunb.	shoebutton ardisia	non-native	rare
<b>MYRTACEAE (Myrtle Family)</b>			

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<i>Pimenta diocia</i> (L.) Merr.	allspice	non-native	common
<i>Psidium cattleianum</i> Sabine	strawberry guava	non-native	rare
<i>Psidium guajava</i> L.	guava	non-native	uncommon
<i>Syzygium cumini</i> (L.) Skeels	Java plum	non-native	uncommon
NYCTAGINACEAE (Four-o'clock Family)			
<i>Bougainvillea spectabilis</i> Willd.	bougainvillea	non-native	rare
OXALIDACEAE (Wood Sorrel Family)			
<i>Oxalis corniculata</i> L.	'ihi'ai	polynesian	uncommon
<i>Oxalis debilis</i> Kunth	pink wood sorrel	non-native	rare
PASSIFLORACEAE (Passion Flower Family)			
<i>Passiflora edulis</i> Sims	passion fruit	non-native	rare
<i>Passiflora suberosa</i> L.	corkystem passion flower	non-native	uncommon
PHYTOLACCACEAE (Pokeweed Family)			
<i>Rivina humilis</i> L.	coral berry	non-native	uncommon
PIPERACEAE (Pepper Family)			
<i>Peperomia blanda</i> Kunth var <i>floribunda</i> (Miq.) H.Huber	'ala'alawainui	indigenous	rare
PLANTAGINACEAE (Plantain Family)			
<i>Plantago lanceolata</i> L.	narrow-leaved plantain	non-native	uncommon
PLUMBAGINACEAE (Plumbago Family)			
<i>Plumbago zeylanica</i> L.	'ilie'e	indigenous	rare
POLYGALACEAE (Milkwort Family)			
<i>Polygala paniculata</i> L.	milkwort	non-native	rare
POLYGONACEAE (Buckwheat Family)			
<i>Antigonon leptopus</i> Hook & Arnott	Mexican creeper	non-native	rare
<i>Rumex obtusifolius</i> L.	bitter dock	non-native	rare
PRIMULACEAE (Primrose Family)			

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<i>Anagallis arvensis</i> L.	scarlet pimpernel	non-native	rare
ROSACEAE (Rose Family)			
<i>Osteomeles anthyllidifolia</i> (Sm.) Lindl.	u'ulei	indigenous	rare
RUBIACEAE (Coffee Family)			
<i>Morinda citrifolia</i> L.	noni	Polynesian	rare
<i>Spermacoce assurgens</i> Ruiz & Pav.	buttonweed	non-native	rare
RUTACEAE (Rue Family)			
<i>Citrus aurantiifolia</i> (Christm.) Swingle	lime	non-native	rare
SAPOTACEAE (Sapodilla Family)			
<i>Chrysophyllum oliviforme</i> L.	satin leaf	non-native	uncommon
SOLANACEAE (Nightshade Family)			
<i>Capsicum frutescens</i> L.	chili pepper	non-native	rare
<i>Solanum americanum</i> Mill.	popolo	indigineous	rare
<i>Solanum torvum</i> Sw.	pea aubergine	non-native	common
STERCULIACEAE (Cacao Family)			
<i>Waltheria indica</i> L.	'uhaloa	indigenous	uncommon
THYMELAEACEAE ('Akia Family)			
<i>Wikstroemia oahuensis</i> (A. Gray) Rock	'akia	endemic	uncommon
TILIACEAE (Linden Family)			
<i>Triumfetta rhomboidea</i> Jacq.	diamond burrbark	non-native	rare
<i>Triumfetta semitriloba</i> Jacq.	Sacramento bur	non-native	uncommon
VERBENACEAE (Verbena Family)			
<i>Lantana camara</i> L.	lantana	non-native	common
<i>Stachytarpheta cayennensis</i> (Rich.) Vahl	nettle-leaved vervain	non-native	uncommon
<i>Stachytarpheta jamaicensis</i> (L.) Vahl	Jamaican vervain	non-native	common
<i>Verbena litoralis</i> Kunth.	ha'u owi	non-native	rare

# FAUNA SURVEY REPORT

## SURVEY METHODS

A walk-through survey method was conducted covering all parts of the project area. Field observations were made using binoculars and by listening to vocalizations. Notes were made on species abundance, activities and locations as well as observations of trails, tracks, scat and signs of feeding. In addition an evening visit was made to record crepuscular activities and vocalizations and to see if there was any evidence of the Endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) in the area.

## MAMMALS

Three species of mammals were observed in the project area during three site visits. Taxonomy and nomenclature follow Tomich (1986).

Domestic cattle (*Bos taurus*) – Numerous cattle were being grazed on all parts of the property as part of a ranching operation.

Domestic horse (*Equus caballus*) – A few horses were also being grazed on the property by the ranch.

Feral pig (*Sus scrofa*) – One pig was seen in the dense brush and diggings and scat were widespread across the property.

Others mammals one might expect to be present, but which were not seen, include: mongoose (*Herpestes auropunctatus*), rats (*Rattus rattus*), mice (*Mus domesticus*) and feral cats (*Felis catus*). Rats and mice feed on seeds, fruits and herbaceous vegetation, and the mongoose and cats hunt for these rodents as well as birds.

A special effort was made to look for the native Hawaiian hoary bat by making an evening survey in the most promising habitat on the property. The limestone bluffs on the lower edge of the property with their adjacent dense forests were reconnoitered during the evening hours for any activity. When present in an area these bats can be easily identified as they forage for insects, their distinctive flight patterns clearly visible in the glow of twilight. No evidence of such activity was observed though visibility was excellent and plenty of flying insects were seen.

Hawaiian hoary bats are extremely rare on O'ahu and no recent sightings have been made in this area.

## **BIRDS**

Birdlife was moderate in both diversity and numbers considering the large size of the property and wide range of habitats. An ample supply of grass and herbaceous plant seeds as well as flying insects and caterpillars were present due to winter rains and spring growth. Sixteen species of birds were recorded during three site visits including fourteen non-native birds and two migratory visitors. Taxonomy and nomenclature follow American Ornithologists' Union (2005).

Zebra dove (*Geopelia striata*) – Small flocks of these doves were found on all parts of the property where they were seen feeding in grassy openings.

Common myna (*Acridotheres tristis*) – Many pairs of mynas were seen in trees or in flight overhead.

Red-vented bulbul (*Pycnonotus cafer*) – Many of these dark birds were seen in trees throughout the property and heard making their warbling calls.

Common waxbill (*Estrilda astrild*) – Several flocks of these tiny birds were seen feeding on grass seeds in forest openings or in flight.

Northern cardinal (*Cardinalis cardinalis*) – Many of these red birds were seen individually or in pairs and more were heard calling from forest trees.

House finch (*Carpodacus mexicanus*) – Small flocks were seen scattered across the property or congregating in ironwood trees.

White-rumped shama (*Copsychus malabaricus*) – Several of these shamas were heard making their prolonged melodic songs from dense forest patches.

Japanese white-eye (*Zosterops japonica*) – Several pairs of these small green birds were seen in forest trees and making their high-pitched calls.

Spotted dove (*Streptopelia chinensis*) – A few of these large doves were seen in flight moving between trees and forest openings.

Cattle egret (*Bubulcus ibis*) – A few of these large white egrets were seen flying over the property especially during the evening when they congregate to roost.

Nutmeg manikin (*Lonchura punctulata*) – A few flocks of these small brown birds were seen in grassy openings and adjacent trees.

Chestnut manikin (*Lonchura Malacca*) – A few of these small reddish-brown birds were seen in grassy openings and adjacent shrubs.

Red-crested cardinal (*Paroaria coronata*) – Two pairs of these red-headed birds was seen and heard calling from forest trees.

African silverbill (*Lonchura cantans*) – One flock of these small pale silverbills was seen in a grassy opening in the lower part of the property.

Pacific golden-plover, Kolea (*Pluvialis fulva*) – Two of these migratory plovers were seen in an open pasture. They were growing out their breeding plumage in preparation for their flight to the arctic in April.

Ruddy turnstone, ‘Akekeke (*Arenaria interpres*) – Two of these migratory turnstones were seen in an open pasture with the plovers. They too are preparing for their summer trip to the arctic breeding grounds.

Five species of native waterbirds, four of which are Endangered species: ae’o or black-necked stilt (*Himantopus mexicanus knudseni*), ‘alae’ula or common moorhen (*Gallinula chloropus sandvicensis*), ‘alae ke’oke’o or Hawaiian coot (*Fulica alai*) and koloa or Hawaiian duck (*Anas wyvilliana*) are known to frequent the extensive protected wetlands of the James Campbell National Wildlife Refuge about a mile away below Kamehameha Highway. These species, however, are all wetland obligates for feeding, breeding and nesting. They may periodically fly high over this subject property transiting between other wetland habitats, but there is no such habitat whatsoever that would attract these birds to land here or to utilize this property in any way. The subject property is also not suitable for Hawaii’s native forest birds that require native forests at higher elevations.

## **INSECTS**

While insects in general were not tallied, they were common throughout the area and fueled much of the bird activity observed. Although not found in the project site, one native Sphingid moth species, Blackburn’s sphinx moth (*Manduca blackburni*), has been put on the federal Endangered species list and this designation requires special focus (USFWS, 2000). Blackburn’s sphinx moth once occurred on Leeward O’ahu although it has not been seen in recent decades. Its native host plants are species of ‘aiea (*Nothocestrum*) in the nightshade family. Some non-native

alternative host plants, all also in the nightshade family, include commercial tobacco (*Nicotiana tabacum*), tree tobacco (*Nicotiana glauca*), tomato (*Solanum lycopersicum*) and eggplant (*Solanum melongena*). None of the above native or non-native host plants were found on the property and no Blackburn's sphinx moth or their larvae were seen.

## **DISCUSSION AND RECOMMENDATIONS**

Fauna surveys are seldom comprehensive due to the short windows of observation, the seasonal nature of animal activities and the usually unpredictable nature of their daily movements. This survey would have recorded a few more non-native mammals and birds had the surveys extended longer and at different times of the year, but it is not likely that it would have found anything that was environmentally significant requiring special consideration.

None of the mammals, birds or insects found on the property are Threatened or Endangered species (USFWS,1999) nor are there any that are candidate for such status. The three mammal species and fourteen of the birds are common non-native species, that are of no environmental concern here in Hawaii. The two migrant birds, the kolea and 'akekeke are seasonally widespread in both the Pacific and the arctic and carry no special federal status. No special fauna habitats were identified on the property either.

There is little of concern regarding the wildlife resources on the property. There is the remote possibility that Endangered waterfowl from the nearby wetlands could be struck by the turbine blades from the proposed windpower project, but as stated earlier there is nothing on the property that would attract these birds to their vicinity. Other than this highly unlikely occurrence, the project plans are not expected to have a significant negative impact on the fauna resources in this part of O'ahu.

<u>COMMON NAME</u>	<u>SCIENTIFIC NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<b><u>MAMMALS</u></b>			
Cattle	<i>Bos taurus</i>	non-native	common
Horse	<i>Equus caballus</i>	non-native	uncommon
Pig	<i>Sus scrofa</i>	non-native	uncommon
<b><u>BIRDS</u></b>			
Zebra dove	<i>Geopelia striata</i>	non-native	common
Common myna	<i>Acridotheres tristis</i>	non-native	common
Red-vented bulbul	<i>Pycnonotus cafer</i>	non-native	common
Common waxbill	<i>Estrilda astrild</i>	non-native	common
Northern cardinal	<i>Cardinalis cardinalis</i>	non-native	common
House finch	<i>Carpodacus mexicanus</i>	non-native	uncommon
White-rumped shama	<i>Copsychus malabarica</i>	non-native	uncommon
Japanese white-eye	<i>Zosterops japonica</i>	non-native	uncommon
Spotted dove	<i>Streptopelia chinensis</i>	non-native	uncommon
Cattle egret	<i>Bubulcus ibis</i>	non-native	uncommon
Nutmeg mannikin	<i>Lonchura punctulata</i>	non-native	rare
Chestnut mannikin	<i>Lonchura malacca</i>	non-native	rare
Red-crested cardinal	<i>Paroaria coronata</i>	non-native	rare
African silverbill	<i>Lonchura cantans</i>	non-native	rare
Kolea, Pacific golden-plover	<i>Pluvialis fulva</i>	migratory	rare
'Akekeke, Ruddy turnstone	<i>Arenaria interpres</i>	migratory	rare

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**BIOLOGICAL RESOURCES SURVEY**

**for the**

**KAHUKU WIND POWER PROJECT**

**KAHUKU, OAHU, HAWAII**

**by**

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July 2009**

**Prepared for: First Wind Energy, LLC**

# **BIOLOGICAL RESOURCES SURVEY KAHUKU WIND POWER PROJECT**

## **INTRODUCTION**

The Kahuku Wind Power project lies on 68.5 acres of land west of Kahuku Town in the foothills of the northwest Koolau Range. The parcel (Lot 1192 – TMK 5-6-05:14) is surrounded on all sides by undeveloped lands above Kamehameha Highway. This biological study was initiated in fulfillment of environmental requirements of the planning process.

## **SITE DESCRIPTION**

The project area lies on sloping land between elevations of 240 feet and 400 feet above sea level. It borders a military access road on its north edge. Vegetation consists of a broad array of dry grasses, brush and scattered trees. Soils are silty clays of the Kemo’o, Paumalu, and Lahaina series, and used to support sugar cane agriculture. Rainfall averages 45 to 50 inches per year with a winter maximum.

## **BIOLOGICAL HISTORY**

In pre-contact times the lower, more gently sloping lands would have been extensively farmed by a large Hawaiian population that lived in the lower valleys and along the sea shore. The ridges would have been covered by a dense tangle of native shrubs such as ‘ūlei (*Osteomeles anthyllidifolia*), ‘akia (*Wikstroemia oahuensis*), ‘iliahi alo’e (*Santalum ellipticum*) and ‘uhaloa (*Waltheria indica*).

In the late 1800s much of the area was converted to sugar cane agriculture. The land was cleared, plowed, burned and harvested in continuous cycles for about 100 years. Much of the steeper land was used to pasture plantation horses and mules. This reduced the numbers and diversity of native plants considerably. Sugar was discontinued in the 1980’s and the land was put into cattle grazing or left idle. Today the area is a largely non-native shrubland and forest consisting of a diverse array of aggressive weedy species and a few tough and persistent native plants that have been able to compete and survive.

## **SURVEY OBJECTIVES**

This report summarizes the findings of a flora and fauna survey of the proposed Kahuku Windfarm Project which was conducted during July, 2009.

The objectives of the survey were to:

1. Document what plant, bird and mammal species occur on the property or may likely occur in the existing habitat.
2. Document the status and abundance of each species.
3. Determine the presence or likely occurrence of any native flora and fauna, particularly any that are Federally listed as Threatened or Endangered. If such occur, identify what features of the habitat may be essential for these species.
4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the flora and fauna in this part of the island.
5. Note which aspects of the proposed development pose significant concerns for plants or for wildlife and recommend measures that would mitigate or avoid these problems.

## **BOTANICAL SURVEY REPORT**

### **SURVEY METHODS**

A walk-through botanical survey method was used following multiple routes to ensure complete coverage of the area. Areas most likely to harbor native plants such as gullies or rock outcrops were more intensively examined. Notes were made on plant species, distribution and abundance as well as terrain and substrate.

### **DESCRIPTION OF THE VEGETATION**

The vegetation on this property is a mixture of aggressive weedy species that have taken over since the abandonment of sugar cane agriculture, but there is also a small complement of native shrubby species scattered across the property. The most abundant plant species encountered during the survey was sourgrass (*Digitaria insularis*) which persists on overgrazed pastures because of its unpalatable nature. Also common were Guinea grass (*Panicum maximum*), Christmas berry (*Schinus terebinthifolius*), kaimi clover (*Desmodium incanum*), koa haole (*Leucaena leucocephala*), shrubby pencil flower (*Stylosanthes fruticosa*), 'uhaloa (*Waltheria indica*), common guava (*Psidium guajava*), Java plum (*Syzygium cumini*) and lantana (*Lantana camara*).

A total of 99 plant species were recorded during the survey. Of this number 7 were native to Hawaii: 'akia (*Wikstroemia oahuensis*), kilau (*Pteridium aquilinum var decompositum*), 'uhaloa, 'ulei (*Osteomeles anthyllidifolia*), pili grass (*Heteropogon contortus*), huehue (*Cocculus orbiculatus*) and pi'ipi'i (*Chrysopogon aciculatus*). None of these are rare species and all are common on multiple islands.

### **DISCUSSION AND RECOMMENDATIONS**

The vegetation of this parcel is dominated by non-native grasses, shrubs and small trees. A few common native plant species are scattered sparsely among the non-native plants, especially in the upper parts of the property. No federally listed Threatened or Endangered plant species (USFWS, 1999) were found on the property, nor were any found that are proposed for such status. There are no special habitats here either.

Due to the lack of unique or sensitive species or habitats there is little of botanical concern with regard to this property and the proposed project is not expected to have a significant negative impact on the botanical resources in this part of O'ahu.

If, however, there is any re-vegetation planned along road cuts or on the margins of tower pads, it is suggested that some of the native species listed above be selected for propagation and outplanting.

## PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within each of four groups: Ferns, Conifers, Monocots and Dicots. Taxonomy and nomenclature of the Conifers and of the flowering plants (Monocots and Dicots) are in accordance with Wagner et al. (1999) and Staples and Herbst, 2005). Ferns follow Palmer, (2003).

For each species, the following information is provided:

1. Scientific name with author citation
2. Common English or Hawaiian name.
3. Bio-geographical status. The following symbols are used:

endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.

indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).

non-native = all those plants brought to the islands intentionally or accidentally after western contact.

Polynesia = all those plants brought to Hawaii by the Polynesians during the course of their migrations.

4. Abundance of each species within the project area:

abundant = forming a major part of the vegetation within the project area.

common = widely scattered throughout the area or locally abundant within a portion of it.

uncommon = scattered sparsely throughout the area or occurring in a few small patches.

rare = only a few isolated individuals within the project area.

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<b>FERNS</b>			
DENNSTAEDTIACEAE (Bracken Fern Family)			
<i>Pteridium aquilinum</i> (L.) Kuhn var. <i>decompositum</i> (Gaud.) R.M.Tryon	kilau, bracken fern	endemic	rare
NEPHROLEPIDACEAE (Sword Fern Family)			
<i>Nephrolepis brownii</i> (Desv.) Hovencamp & Miyam.	Asian sword fern	non-native	uncommon
POLYPODIACEAE (Polypody Fern Family)			
<i>Phymatosorus grossus</i> (Langsdon&Fisch.) Brownlie	laua'e	non-native	uncommon
PTERIDACEAE (Brake Fern Family)			
<i>Cheilanthes viridis</i> (Forssk.) Sw.	green cliff brake	non-native	uncommon
<b>CONIFERS</b>			
PINACEAE (Pine Family)			
<i>Pinus radiata</i> D. Don	Monterey Pine	non-native	rare
<b>MONOCOTS</b>			
ARECACEAE (Palm Family)			
<i>Cocos nucifera</i> L.	coconut, niu	Polynesian	rare
<i>Phoenix x dactylifera</i>	hybrid date palm	non-native	rare
ASPARAGACEAE (Asparagus Family)			
<i>Cordyline fruticosa</i> (L.) A. Chev.	ki, ti leaf	Polynesian	rare
COMMELINACEAE (Spiderwort Family)			
<i>Commelina diffusa</i> N.L. Burm.	honohono	non-native	rare
CYPERACEAE (Sedge Family)			
<i>Cyperus gracilis</i> R. Br.	McCoy grass	non-native	rare
POACEAE (Grass Family)			
<i>Andropogon virginicus</i> L.	broomsedge narrow-leaved	non-native	uncommon
<i>Axonopus fissifolius</i> (Raddi) Kuhlman.	carpetgrass	non-native	uncommon

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<i>Bothriochloa barbinodis</i> (Lag.) Herter	fuzzy top	non-native	rare
<i>Bothriochloa pertusa</i> (L.) A. Camus	pitted beardgrass	non-native	uncommon
<i>Chrysopogon aciculatus</i> (Retz.) Trin.	pi'ipi'i	indigenous	uncommon
<i>Cynodon dactylon</i> (L.) Pers.	Bermuda grass	non-native	uncommon
<i>Digitaria ciliaris</i> (Retz.) Koeler	Henry's crabgrass	non-native	uncommon
<i>Digitaria insularis</i> (L.) Mez ex Ekman.	sourgrass	non-native	abundant
<i>Eleusine indica</i> (L.) Gaertn.	wiregrass	non-native	rare
<i>Heteropogon contortus</i> (L.) Beauv.	pili grass	indigenous	rare
<i>Hyparrhenia rufa</i> (Nees) Stapf	thatching grass	non-native	rare
<i>Melinis repens</i> (Willd.) Zizka	Natal redtop	non-native	uncommon
<i>Panicum maximum</i> Jacq.	Guinea grass	non-native	common
<i>Paspalum conjugatum</i> Bergius	Hilo grass	non-native	rare
<i>Paspalum dilatatum</i> Poir.	Dallis grass	non-native	uncommon
<i>Pennisetum polystachion</i> (L.) Schult.	feathery pennisetum	non-native	rare
<i>Setaria parvilfora</i> (Poir.) Kerguelen	yellow foxtail	non-native	uncommon
<i>Sporobolus africanus</i> (Poir.) Robyns & Tournay	African dropseed	non-native	uncommon
<b>DICOTS</b>			
ACANTHACEAE (Acanthus Family)			
<i>Asystasia gangetica</i> (L.) T. Anderson	Chinese violet	non-native	uncommon
AMARANTHACEAE (Amaranth Family)			
<i>Acyranthes aspera</i> L.	-----	non-native	rare
<i>Amaranthus spinosus</i> L.	spiny amaranth	non-native	rare
ANACARDIACEAE (Mango Family)			
<i>Mangifera indica</i> L.	mango	non-native	rare

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<i>Schinus terebinthifolius</i> Raddi	Christmas berry	non-native	common
APIACEAE (Parsley Family)			
<i>Centella asiatica</i> (L.) Urb.	Asiatic pennywort	non-native	rare
ARALIACEAE (Ginseng Family)			
<i>Shefflera actinophylla</i> (Endl.) Harms	octopus tree	non-native	rare
ASTERACEAE (Sunflower Family)			
<i>Acanthospermum australe</i> (Loefl.) Kuntze	spiny bur	non-native	uncommon
<i>Bidens alba</i> (L.) DC	-----	non-native	uncommon
<i>Conyza bonariensis</i> (L.) Cronq.	hairy horseweed	non-native	uncommon
<i>Elephantopus mollis</i> Kunth	-----	non-native	rare
<i>Emilia fosbergii</i> Nicolson	red pualele	non-native	rare
<i>Emilia sonchifolia</i> (L.) DC.	violet pualele	non-native	rare
<i>Pluchea carolinensis</i> (Jacq.) G.Don	sourbush	non-native	uncommon
<i>Pluchea indica</i> (L.) Less.	Indian fleabane	non-native	rare
<i>Xanthium strumarium</i> L.	kikania	non-native	uncommon
BIGNONIACEAE (Bignonia Family)			
<i>Spathodea campanulata</i> P.Beauv.	African tulip tree	non-native	rare
CASUARINACEAE (She-oak Family)			
<i>Casuarina equisetifolia</i> Stickm.	common ironwood	non-native	rare
<i>Casuarina glauca</i> Sieber ex Spreng.	longleaf ironwood	non-native	rare
EUPHORBIACEAE (Spurge Family)			
<i>Macaranga tanarius</i> (L.) Mull. Arg.	parasol leaf tree	non-native	rare
<i>Phyllanthus debilis</i> Klein ex Willd.	niruri	non-native	rare
FABACEAE (Pea Family)			
<i>Acacia confusa</i> Merr.	Formosa koa	non-native	uncommon
<i>Acacia farnesiana</i> (L.) Willd.	klu	non-native	rare

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<i>Chamaecrista nictitans</i> (L.) Moench	partridge pea	non-native	uncommon
<i>Crotalaria incana</i> L.	fuzzy rattlepod	non-native	rare
<i>Crotalaria retusa</i> L.	rattlepod	non-native	rare
<i>Desmanthus pernambucanus</i> (L.) Thellung	slender mimosa	non-native	uncommon
<i>Desmodium incanum</i> DC.	ka'imi clover	non-native	common
<i>Desmodium triflorum</i> (L.) DC.	three-flowered beggarweed	non-native	rare
<i>Indigofera suffruticosa</i> Mill.	inikö	non-native	rare
<i>Leucaena leucocephala</i> (Lam.) de Wit	koa haole	non-native	common
<i>Mimosa pudica</i> L.	sensitive plant	non-native	uncommon
<i>Neonotonia wightii</i> (Wight & Arnott) Lackey	glycine	non-native	uncommon
<i>Senna occidentalis</i> (L.) Link	coffee senna	non-native	rare
<i>Senna surattensis</i> (N.L. Burm.) H. Irwin & Barneby	kolomona	non-native	uncommon
<i>Stylosanthes fruticosa</i> (Retz.) Alston	shrubby pencil flower	non-native	common
LAMIACEAE (Mint Family)			
<i>Hyptis pectinata</i> (L.) Poit.	comb hyptis	non-native	uncommon
<i>Leonotis nepetifolia</i> (L.) R. Br.	lion's ear	non-native	uncommon
MALVACEAE (Mallow Family)			
<i>Abutilon grandifolium</i> (Willd.) Sweet	hairy abutilon	non-native	uncommon
<i>Malvastrum coromandelianum</i> (L.) Garcke	false mallow	non-native	uncommon
<i>Sida cordifolia</i> L.	-----	non-native	rare
<i>Sida rhombifolia</i> L.	Cuban jute	non-native	uncommon
<i>Sida spinosa</i> L.	prickly sida	non-native	uncommon
<i>Triumfetta rhomboidea</i> Jacq.	-----	non-native	rare
<i>Triumfetta semitriloba</i> Jacq.	Sacramento bur	non-native	uncommon

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<i>Waltheria indica</i> L.	'uhaloa	indigenous	common
MELASTOMATACEAE (Melastoma Family)			
<i>Clidemia hirta</i> (L.) D.Don	Koster's curse	non-native	uncommon
MENISPERMACEAE (Moonseed Family)			
<i>Cocculus orbiculatus</i> (L.) DC.	huehue	indigenous	uncommon
MORACEAE (Fig Family)			
<i>Ficus platypoda</i> (A. Cunn. ex Miq.) A. Cunn. ex Miq.	rock fig	non-native	rare
MYRSINACEAE (Myrsine Family)			
<i>Ardisia elliptica</i> Thunb.	shoebuttan ardisia	non-native	rare
MYRTACEAE (Myrtle Family)			
<i>Pimenta dioica</i> (L.) Merr.	allspice	non-native	uncommon
<i>Psidium cattleianum</i> Sabine	strawberry guava	non-native	uncommon
<i>Psidium guajava</i> L.	common guava	non-native	common
<i>Syzygium cumini</i> (L.) Skeels	Java plum	non-native	common
OXALIDACEAE (Wood Sorrel Family)			
<i>Oxalis corniculata</i> L.	yellow wood sorrel	Polynesian	rare
PASSIFLORACEAE (Passion Flower Family)			
<i>Passiflora edulis</i> Sims	passion fruit	non-native	rare
<i>Passiflora foetida</i> L.	love-in-a-mist	non-native	rare
<i>Passiflora suberosa</i> L.	huehue haole	non-native	rare
PHYTOLACCACEAE (Pokeweed Family)			
<i>Rivina humilis</i> L.	rouge plant	non-native	rare
PLANTAGINACEAE (Plantain Family)			
<i>Plantago lanceolata</i> L.	narrow-leaved plantain	non-native	uncommon
POLYGALACEAE (Milkwort Family)			

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
<i>Polygala paniculata</i> L.	-----	non-native	rare
ROSACEAE (Rose Family)			
<i>Osteomeles anthyllidifolia</i> (Sm.) Lindl.	'ulei	indigenous	uncommon
RUBIACEAE (Coffee Family)			
<i>Morinda citrifolia</i> L.	noni	Polynesian	rare
<i>Spermacoce assurgens</i> Ruiz & Pav.	buttonweed	non-native	rare
SOLANACEAE (Nighshade Family)			
<i>Capsicum frutescens</i> L.	chili pepper	non-native	uncommon
<i>Solanum torvum</i> Sw.	pea aubergine	non-native	uncommon
THYMELAEACEAE ('Akia Family)			
<i>Wikstroemia oahuensis</i> (A. Gray) Rock	'akia	endemic	uncommon
VERBENACEAE (Verbena Family)			
<i>Lantana camara</i> L.	lantana	non-native	common
<i>Stachytarpheta australis</i> Modenke	owi	non-native	uncommon
<i>Stachytarpheta cayennensis</i> (Rich.) Vahl	nettle-leaved vervain	non-native	uncommon
<i>Stachytarpheta jamaicensis</i> (L.) Vahl	Jamaican vervain	non-native	uncommon

## FAUNA SURVEY REPORT

### SURVEY METHODS

A walk-through survey method was conducted in conjunction with the botanical survey. All parts of the project area were covered. Field observations were made with the aid of binoculars and by listening to vocalizations. Notes were made on species, abundance, activities and location as well as observations of trails, tracks scat and signs of feeding. In addition an evening visit was made to the area to record crepuscular activities and vocalizations and to see if there was any evidence of occurrence of the Hawaiian hoary bat (*Lasiurus cinereus semotus*) in the area.

### RESULTS

#### MAMMALS

Two species of mammals were observed during three site visits to the property. Taxonomy and nomenclature follow Tomich (1986).

Cattle (*Bos taurus*) – There was quite a bit of old cattle sign scattered about the property. This was from former grazing on this land.

Mongoose (*Herpestes auropunctatus*) – A few mongoose were seen scurrying through the underbrush where they hunt for rodents and birds.

Dense vegetation prevented good visibility of other small mammals. One would expect to find rats (*Rattus spp.*) and mice (*Mus domesticus*) in this type of habitat and one would expect a few feral cats (*Felis catus*) which would hunt for these rodents as well as birds.

#### BIRDS

Moderate birdlife diversity was observed within the project area during three site visits. Thirteen bird species were recorded including twelve non-native species and one indigenous seabird. Taxonomy and nomenclature follow American Ornithologists' Union (2005).

Red-vented bulbul (*Pycnonotus cafer*) – These dark bulbuls were abundant on all parts of this property, flying between trees and making their warbling calls.

Zebra dove (*Geopelia striata*) – These small doves were scattered throughout the property in small flocks.

Cattle egret (*Bubulcus ibis*) – A few individuals were seen during the day and small flocks were seen flying overhead heading for roosting trees during the evening.

Red-crested cardinal (*Paroaria coronata*) – A couple families of these bright red-headed birds were seen foraging in trees.

Japanese white-eye (*Zosterops japonicus*) – Several pairs of these small green birds were seen foraging for caterpillars in small trees and making their high pitched calls.

Common myna (*Acridotheres tristis*) – A few pairs of mynas were seen flying between trees throughout the property.

Northern cardinal (*Cardinalis cardinalis*) – A few of these red cardinals were seen darting about in dense forest and making their loud distinctive calls.

Red-billed leiothrix (*Leiothrix lutea*) – A few of these colorful birds were seen and heard calling from dense forest in a gully.

Spotted dove (*Streptopelia chinensis*) – Three of these large doves were seen flying between trees across the property.

Northern mockingbird (*Mimus polyglottos*) – Two mockingbirds were seen flying between trees flashing their long tail feathers.

Common waxbill (*Estrilda astrild*) – One flock of these tiny birds was seen feeding in tall grass during the late afternoon.

Red-whiskered bulbul (*Pycnonotus jocosus*) – One of these bulbuls was seen in a small tree during the late afternoon.

‘Iwa, Great frigatebird (*Fregata minor*) – One ‘iwa was seen cruising high over the property during the evening. This bird was looking for incoming seabirds he could rob of their daily catch. The ‘iwa is a widespread and common seabird throughout the tropical Pacific.

This study area is situated about  $\frac{3}{4}$  mile above the substantial wetlands of the James Campbell National Wildlife Refuge that provides habitat for three Endangered Waterbirds, the ‘alae ‘ula or common moorhen (*Gallinula chloropus sandvicensis*), the ‘alae ke’oke’o or Hawaiian coot (*Fulica alai*) and the ae’o or Hawaiian stilt (*Himantopus mexicanus knudseni*) as well as other commoner waterbirds and shorebirds. These birds fly substantial distances and could overfly the project area enroute to other wetland habitats. This area, however, has no wetland habitat to attract such waterbirds and none were seen.

## **INSECTS**

While insects in general were not tallied, they were common throughout the property. Although not found on the property, one native sphingid moth, Blackburn's sphinx moth (*Manduca blackburni*), has been put on the Federal Endangered species list and this designation requires special focus (USFWS, 2000). Blackburn's sphinx moth was known to occur on O'ahu in the past, although it has not been found here recently. Its native host plants are species of 'aiea (*Nothocestrum spp.*) and alternative host plants are tobacco (*Nicotiana tabacum*) and tree tobacco (*Nicotiana glauca*). There are no 'aiea on or near the property, and no tobacco or tree tobacco were found on the property. No Blackburn's sphinx moth or their larvae were found.

## **DISCUSSION AND RECOMMENDATIONS**

Most of the wildlife found on this property is non-native and is of little concern from a conservation standpoint. There are, however, wetlands in the Kahuku area that provide habitat for Endangered waterbirds, and the Endangered Hawaiian hoary bat has been detected about a mile to the southeast in a recent survey. The presence of these Endangered volant birds and bat in the general vicinity of proposed wind turbines raises concerns for their safety that may need to be addressed proactively in consultation with the U.S. Fish and Wildlife Service which exercises jurisdiction over these animals under the authority of the Endangered Species Act.

No other concerns regarding the wildlife of this project area are anticipated and no further recommendations are offered.

## ANIMAL SPECIES LIST

Following is a checklist of the animal species inventoried during the field work. Animal species are arranged in descending abundance within two groups: Mammals and Birds. For each species the following information is provided:

1. Common name
2. Scientific name
3. Bio-geographical status. The following symbols are used:

endemic = native only to Hawaii; not naturally occurring anywhere else in the world.

indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).

non-native = all those animals brought to Hawaii intentionally or accidentally after western contact.

migratory = spending a portion of the year in Hawaii and a portion elsewhere. In Hawaii the migratory birds are usually in the overwintering/non-breeding phase of their life cycle.

4. Abundance of each species within the project area:

abundant = many flocks or individuals seen throughout the area at all times of day.

common = a few flocks or well scattered individuals throughout the area.

uncommon = only one flock or several individuals seen within the project area.

rare = only one or two seen within the project area.

<u>COMMON NAME</u>	<u>SCIENTIFIC NAME</u>	<u>STATUS</u>	<u>ABUNDANCE</u>
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**MAMMALS**

Cattle	<i>Bos taurus</i>	non-native	uncommon
Mongoose	<i>Herpestes auropunctatus</i>	non-native	uncommon

**BIRDS**

Red-vented bulbul	<i>Pycnonotus cafer</i>	non-native	abundant
Zebra dove	<i>Geopelia striata</i>	non-native	uncommon
Cattle egret	<i>Bubulcus ibis</i>	non-native	uncommon
Red-crested cardinal	<i>Paroaria coronata</i>	non-native	uncommon
Japanese white-eye	<i>Zosterops japonicus</i>	non-native	uncommon
Common myna	<i>Acridotheres tristis</i>	non-native	uncommon
Northern cardinal	<i>Cardinalis cardinalis</i>	non-native	uncommon
Red-billed leiothrix	<i>Leiothrix lutea</i>	non-native	uncommon
Spotted dove	<i>Streptopelia chinensis</i>	non-native	uncommon
Northern mockingbird	<i>Mimus polyglottos</i>	non-native	rare
Common waxbill	<i>Estrilda astrild</i>	non-native	rare
Red-whiskered bulbul	<i>Pycnonotus jocosus</i>	non-native	rare
'Iwa, Great frigatebird	<i>Fregata minor palmerstoni</i>	indigenous	rare

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