
**A Survey of Botanical, Avian, and Mammalian
Resources, Kapolei Harborside Center,
'Ewa District, O'ahu, Hawai'i.**

Prepared for:

Group 70 International, Inc.
925 Bethel Street, Fifth Floor
Honolulu, Hawai'i 96813

Prepared by:

Reginald E. David
Rana Productions, Ltd.
P.O. Box 1371
Kailua-Kona, Hawai'i 96745

&

Eric Guinther
AECOS Consultants
45-309 Akimala Place
Kaneohe, Hawai'i 96744

October 2, 2006.

Table of Contents

<i>Table of Contents</i>	2
<i>Introduction</i>	3
<i>General Site Description</i>	3
<i>Mammalian Survey Methods</i>	5
<i>Mammalian Survey Results</i>	5
<i>Avian Survey Methods</i>	5
<i>Avian Survey Result</i>	5
<i>Botanical Survey Methods</i>	8
<i>Botanical Survey Results</i>	8
<i>Discussion</i>	14
<i>Mammalian Resources</i>	15
<i>Avian Resources</i>	16
<i>Botanical Resources</i>	17
<i>Conclusions</i>	18
<i>Faunal Resources</i>	18
<i>Botanical Resources</i>	18
<i>Glossary</i>	19
<i>Literature Cited</i>	20

Figures & Tables

Figure 1. Kapolei Harborside Center Site.....	4
Figure 2. Kapolei Harborside Center Site Botanical Survey Routes.....	9
Table 1. Avian Species Detected, Kapolei Harborside Center Site.....	6
Table 2. Flora Listing, Kapolei Harborside Center Site.....	11

Introduction

Kapolei Property Development, LLC, an affiliate of the Estate of James Campbell, is proposing to develop an industrial park on approximately 345-acres of land in Honouliuli, 'Ewa District, Kapolei, O'ahu (Figure 1). This report summarizes the findings of the botanical, avian and mammalian surveys that were conducted to determine the potential effects of the proposed development on biological resources present on the site, and within the general project area.

A primary goal of the surveys was to determine if there were any Federal or State of Hawai'i listed endangered, threatened, proposed, or candidate avian, mammalian or botanical resources on, or in the immediate vicinity of the proposed project site. Federal and State of Hawai'i listed species status follows species identified in the following referenced documents (DLNR, 1998, Federal Register, 1999, 2005). Fieldwork was conducted on May 4, 2006.

The avian phylogenetic order and nomenclature used in this report follows *The American Ornithologists' Union Checklist of North American Birds 7th Edition* (American Ornithologists' Union 1998), and the 42nd through the 46th supplements to *Check-list of North American Birds* (American Ornithologists' Union 2000; Banks et al. 2002, 2003, 2004, 2005). Mammal scientific names follow *Mammals in Hawaii* (Tomich 1986). Higher native and naturalized plant names follow *Manual of the Flowering Plants of Hawai'i* (Wagner et al. and Wagner and Herbst, 1990, 1999). Ornamental plant names follow *A Tropical Garden Flora: Plants Cultivated in the Hawaiian Islands and Other Tropical Places* (Staples and Herbst 2005). Place names follow *Place Names of Hawaii* (Pukui et al. 1974).

Hawaiian and scientific names are italicized in the text. A glossary of technical terms and acronyms used in the document, which may be unfamiliar to the reader, are included at the end of the narrative text on (Page 19).

General Site Description

The project site, is bounded by vacant, industrially-zoned land, Kalealoa Boulevard and Kapolei Business Park to the east, Malakole Road and Campbell Industrial Park to the south, Kalaaloa/Barbers Point Harbor and supporting industrial areas to the west and the proposed Kapolei West master planned community to the north (Figure 1).

The project site is owned by Kapolei Property Development, LLC, Aina Nui Corporation and the Estate of James Campbell and is proposed for development by Kapolei Property Development, LLC. The project area encompasses several parcels including Tax Map Key (TMK) (1) 9-1-14:33 (por) (137.529-acres), (1) 9-1-14:34 (19.947-acres), (1) 9-1-15:20 (por) (174.198-acres), and (1) 9-1-14:35 (12.845-acres).

Figure 1 Kapolei Harborside Center Project Site



The project area currently has several different users operating various operations on-site, although the majority of the parcel is vacant. Existing uses include a nursery, intermittent agricultural use, a greenwaste collection and compost processing operation, fill material stockpiling, and a coal conveyor belt that transports coal from the harbor to power stations located south of the site.

Full-time agricultural uses on the site ended in 1995 after O'ahu Sugar Company ceased cultivation of approximately 145-acres in sugar cane cultivation. Over 200-acres of the site was previously utilized for coral mining operations for the manufacture of cement and concrete products.

Mammalian Survey Methods

All observations of mammalian species were of an incidental nature. With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or 'ōpe'ape'a as it is known locally, all terrestrial mammals currently found on the Island of O'ahu are alien species, and most are ubiquitous. The survey of mammals was limited to visual and auditory detection, coupled with visual observation of scat, tracks, and other animal signs. A running tally was kept of all vertebrate species observed and heard within the study area.

Mammalian Survey Results

Three mammalian species were detected while on the site: domestic dog (*Canis f. familiaris*), small Indian mongoose (*Herpestes a. auropunctatus*), and cat (*Felis catus*). We saw one mongoose as well as tracks and sign of dog, mongoose and cats at numerous locations within the project site. All three of these are introduced species that are considered deleterious to native avian species and Hawaiian ecosystems.

Avian Survey Methods

Fourteen avian count stations were sited at approximately 300-meter intervals along linear transects running from north-to-south through the project area. One six-minute point count was conducted at each station. Field observations were made using Leitz 10 X 42 binoculars to sight birds and by listening for vocalizations. Counts took place between 07:30 a.m. and 10:30 a.m., the peak of daily bird activity. Time not spent conducting station counts was used to search the area for species and habitats not detected during count sessions.

Avian Survey Results

A total of 441 individual birds of 18 different avian species, representing 15 separate families were recorded during station counts. An additional species, Cattle Egret (*Bubuleus ibis*), was recorded as an incidental observation while transiting between count stations (Table 1).

Table 1. Avian Species Detected, Kapolei Harborside Center Site

<i>Common Name</i>	<i>Scientific Name</i>	<i>ST</i>	<i>RA</i>	<i>NT</i>
ANSERIFORMES				
ANATIDAE - Ducks, Geese & Swans				
Anserinae - Ducks				
Hawaiian Duck x Mallard hybrid	<i>Anas wyvilliana</i> x <i>A. platyrhynchos</i>	EH		(A)
GALLIFORMES				
PHASIANIDAE - Pheasants & Partridges				
Phasianinae - Pheasants & Allies				
Gray Francolin	<i>Francolinus pondicerianus</i>	A	0.14	
Black Francolin	<i>Francolinus francolinus</i>	A	0.43	
CICONIIFORMES				
ARDEIDAE - Herons, Bitterns & Allies				
Cattle Egret	<i>Bubulcus ibis</i>	A	1-1	(B)
Black-crowned Night-Heron	<i>Nycticorax nycticorax hoactli</i>	IR	0.07	
CHARADRIIFORMES				
CHARADRIIDAE - Lapwings & Plovers				
Charadriinae - Plovers				
Pacific Golden-Plover	<i>Pluvialis fulva</i>	IM	0.64	
RECURVIROSTRIDAE - Stilts & Avocets				
Black-necked Stilt	<i>Himantopus mexicanus knudseni</i>	ER	0.57	
SCOLOPACIDAE - Sandpipers, Phalaropes & Allies				
Scolopacinae - Sandpipers & Allies				
Ruddy Turnstone	<i>Arenaria interpres</i>	IM	0.57	
COLUMBIFORMES				
COLUMBIDAE - Pigeons & Doves				
Spotted Dove	<i>Streptopelia chinensis</i>	A	5.14	
Zebra Dove	<i>Geopelia striata</i>	A	3.00	
PASSERIFORMES				
PYCNONOTIDAE - Bulbuls				
Red-vented Bulbul	<i>Pycnonotus cafer</i>	A	3.86	
ZOSTEROPIDAE - White-Eyes				
Japanese White-eye	<i>Zosterops japonicus</i>	A	1.93	
MIMIDAE - Mockingbirds & Thrushes				
Northern Mockingbird	<i>Mimus polyglottos</i>	A	0.64	

Common Name	Scientific Name	ST	RA	NT
	STURNIDAE - Starlings			
Common Myna	<i>Acridotheres tristis</i>	A	3.93	
	EMBERIZIDAE - Emberizids			
Red-crested Cardinal	<i>Paroaria coronata</i>	A	0.50	
	CARDINALIDAE - Cardinals Saltators & Allies			
Northern Cardinal	<i>Cardinalis cardinalis</i>	A	0.64	
	FRINGILLIDAE - Fringilline And Cardueline Finches & Allies			
	Carduelinae - Cardueline Finches			
House Finch	<i>Carpodacus mexicanus</i>	A	1.79	
	PASSERIDAE - Old World Sparrows			
House Sparrow	<i>Passer domesticus</i>	A	0.43	(B)
	ESTRILDIDAE - Estrildid Finches			
	Estrildinae - Estrildine Finches			
Common Waxbill	<i>Estrilda astrild</i>	A	6.43	
Red Avadavat	<i>Amandava amandava</i>	A	0.23	
Chestnut Munia	<i>Lonchura atricapilla</i>	A	0.50	

KEY TO TABLE 1

ST Status

EH Endangered Endemic Hybrid Species

ER Endangered Resident Species

IM Indigenous Migrant – a native migratory species that winters in Hawai'i but breeds elsewhere

IR Indigenous Resident Species

A Alien – introduced to the Hawaiian Islands by humans

RA Relative Abundance – Number of birds detected divided by the number of count stations (14)

I - Incidental observation, followed by the number of individuals recorded

NT Note, see below for explanation of notes (A) and (B)

(A) Not recorded during this survey, but recorded during the 2005 survey (David and Guinther 2005)

(B) Recorded on this survey but not on during the 2005 survey (David and Guinther 2005)

Four of the species recorded, Black-crowned Night-Heron (*Nycticorax nycticorax hoactli*), Pacific Golden-Plover (*Pluvialis fulva*), Black-necked Stilt (*Himantopus mexicanus knudseni*), and Ruddy Turnstone (*Arenaria interpres*) are native to the Hawaiian islands. The Black-necked Stilt is a resident endangered endemic sub-species. The Black-crowned Night-Heron is an indigenous resident species, and the Pacific Golden-Plover and Ruddy Turnstone are both indigenous migratory waterbird species. The remaining 15 species detected during the course of this survey are considered to be alien to the Hawaiian Islands (Table 1).

Avian diversity was relatively low, though densities of several species were relatively high. Three species: Common Waxbill (*Estrilda astrild*), Common Myna (*Acridotheres*

tristis), and Red-vented Bulbul (*Pycnonotus cafer*), accounted for slightly more than 45% of the total number of individual birds recorded. Common Waxbills were the most frequently recorded species, accounting for slightly more than 20% of the total number of individual birds recorded during station counts. We recorded an average of 32 birds per station count.

Botanical Survey Methods

A pedestrian botanical survey was conducted on May 4, 2006 noting the occurrence and relative abundance of all species of plants observed. Wandering transects were used to cover the area in combination with a previous survey undertaken in August 2005 (David & Guinther, 2005) to yield reasonably complete coverage of all of the property proposed for the Kapolei Harborside Development. As the survey progressed, 19 waypoints (intermittent position locations) were entered into a hand-held GPS unit (Garmin *etrex* "Vista"®). These 19 points were later downloaded into a computer mapping program (TOPO!®) and a map produced showing the general route of the survey (Figure 2; waypoints shown as blue diamonds with red centers). Because only waypoints of the botanists were recorded, the actual ground covered during the biological surveys was more extensive, in addition to the fact that the actual route was more convoluted than shown. A dashed blue line shows the approximate route taken by the botanist in August 2005 covering more of the interior of the project area. Only the southeast corner of the Kapolei Harborside Development area was not surveyed. This parcel is occupied by a nursery, a survey of which would provide minimal value in understanding impacts on natural vegetation of the project site.

This survey was conducted following a relatively wet period on O'ahu. Consequently, most of the plants encountered (including annuals) were growing well and were in flower, making positive field identifications relatively easy.

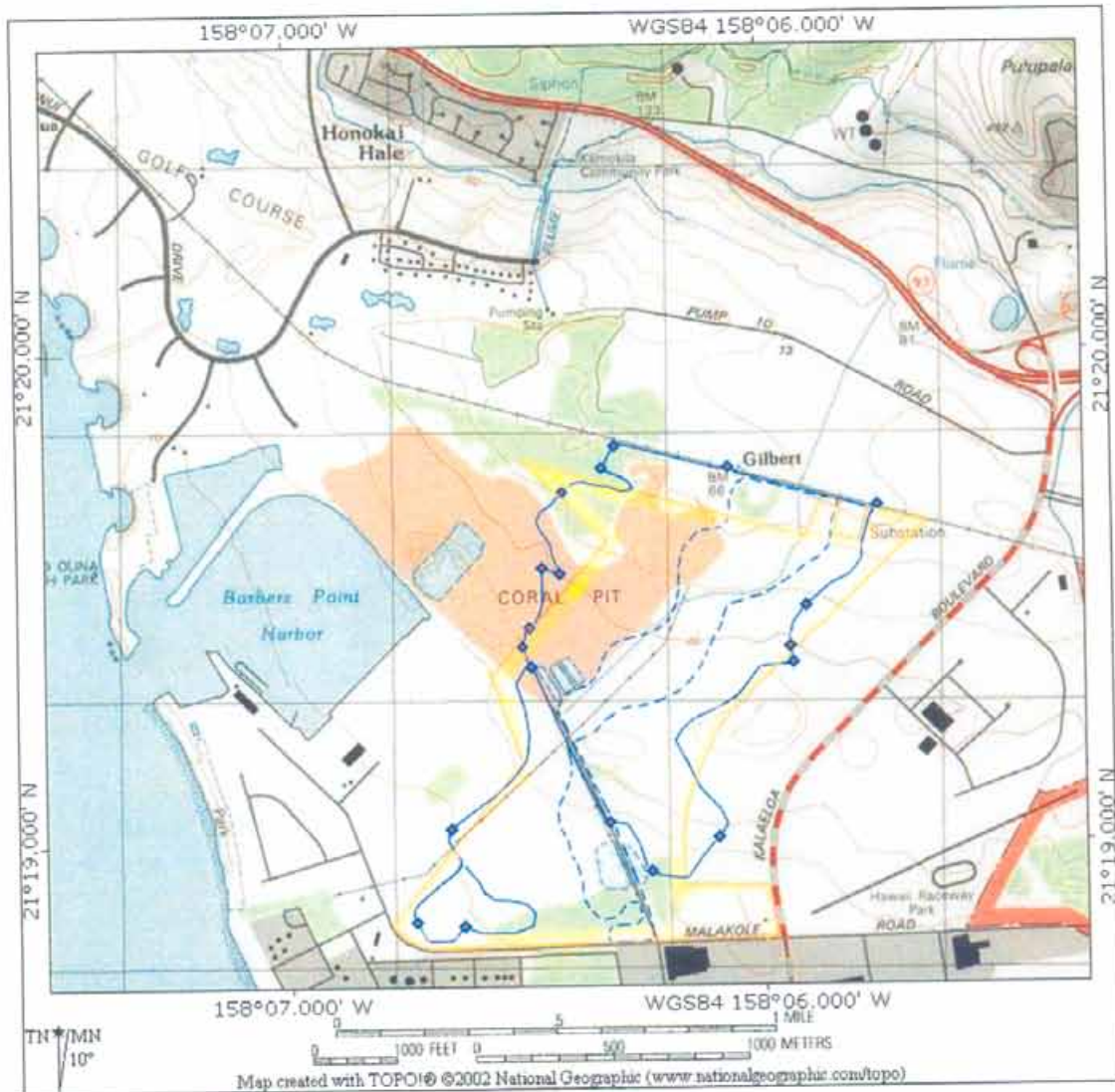
Botanical Survey Results

The project area is characterized by several distinct vegetation areas: 1) quarry and dredged material tailings, 2) former agriculture lands now abandoned, and 3) *kiawe* (*Prosopis pallida*) and buffelgrass (*Cenchrus ciliaris*) lowland forest and savannah.

Quarry and dredged spoil areas are characterized by extensive bare calcareous soil and sediment deposits, with isolated pockets of vegetation and pioneer species growing in less recently disturbed parts. This environment type covers nearly all of the western half of the project area. Numerous weedy species occur here, and there is evidence of ephemeral flooding and ponding, creating special habitats that support many plants (such as California grass, *Urochloa mutica*, and sprangletop, *Leptochloa uninervia*) that otherwise would not occur in this area. Despite the origin of the sediment being material accumulated from the dredging of Barbers Point Deep Draft Harbor, ephemeral pools no longer show evidence of salt encrustations upon drying out. Conspicuous plants

characteristic of the wasteland environment are tree tobacco (*Nicotiana glauca*) and Russian thistle or tumbleweed (*Salsola tragus*).

Figure 2. Kapolei Harborside Center Site Survey Routes



Map of Barbers Point Harbor and vicinity showing approximate project boundary (outlined in orange) and survey routes in blue: solid line = May 2006 with GPS points plotted; dashed line = August 2005 from memory.

Former agriculture lands were once in sugar cane (Char & Associates, 1989), and evidence of subsequent truck crops (melons, corn) is still present, but the fields occupying the eastern half of the project area from the railroad right-of-way south for about 2/3 of the project site length appear to have been abandoned for over a year. This area is characterized by numerous ruderal weeds that spread over the fields after agricultural operations ceased.

The remainder of the area, being mostly the northwestern corner and land between the former agriculture fields and the Milo Nursery in the southeast corner, is occupied by an open to closed *kiawe* forest with a dense undergrowth of buffelgrass. In some areas, koa haole (*Leucaena leucocephala*) is prominent as scrub growth. The *kiawe* forest at the north end has suffered fires in recent years, and many of the trees are burned and pushed over.

A plant checklist (Table 2) was compiled from the observations, with entries arranged alphabetically under family names. Included in the list are scientific name, common name, and status (whether native or not-native) of each species.

In addition to identifying the plants present within the study site, qualitative estimates of plant abundance were made. These are coded in the table as explained in the Legend to Table 2 and apply to observations made during the present survey. However, the table lists all species recorded in the present survey as well as those listed in two previous surveys: David & Guinther (2005; for area surveyed as shown in Figure 2) and Char & Associates (1989), providing a more complete list of plant species likely to be found in the project area. The Char & Associates (1989) survey covered a larger area than that delineated for the Kapolei Harborside Development, the east boundary extended further east to and a little beyond the map border in Figure 2. Species unique to this additional area and not found in the project area could not be eliminated from the Char list, but this fact does not alter any conclusions presented in this report.

Table 2. Flora Listing, Kapolei Harborside Center Site

<i>Species listed by family</i>	<i>Common name</i>	<i>Status</i>	<i>Abundance</i>	<i>Notes</i>
FLOWERING PLANTS				
DICOTYLEDONES				
ACANTHACEAE				
<i>Asystasia gangetica</i> (L.) T. Anderson	Chinese violet	Nat.	U	
AIZOACEAE				
<i>Sesuvium portulacastrum</i> (L.) L.	'akulikuli	Ind.	U1	
<i>Trianthema portulacastrum</i> L.	---	Nat.	--	(1)
AMARANTHACEAE				
<i>Achyranthes aspera</i> L.	---	Nat.	--	(1,2)
<i>Alternanthera pungens</i> Kunth	khaki weed	Nat.	O2	
<i>Alternanthera sessilis</i> (L.) DC	sessile joyweed	Nat.	--	(2)
<i>Amaranthus spinosus</i> L.	spiny amaranth	Nat.	O	
<i>Amaranthus viridis</i> L.	slender amaranth	Nat.	R	
ANACARDIACEAE				
<i>Mangifera indica</i> L.	mango	Nat.	--	(2,3)
<i>Schinus terebinthifolius</i> Raddi	Christmasberry	Nat.	U	
APIACEAE				
<i>Ciclospermum leptophyllum</i> (Pers.) Sprague	fir-leaved celery	Nat.	--	(2)
ASTERACEAE (COMPOSITAE)				
<i>Ageratum conyzoides</i> L.	<i>maile honohono</i>	Nat.	--	(2)
<i>Bidens pilosa</i> L.	<i>ki</i>	Nat.	--	(1)
<i>Conyza bonariensis</i> (L.) Cronq.	hairy horseweed	Nat.	--	(1,2)
<i>Conyza canadensis</i> (L.) Cronq.	horseweed	Nat.	--	(2)
<i>Crasocephalum crepidioides</i> (Benth.) S. Moore	---	Nat.	--	(2)
<i>Dyssodia tenuiloba</i> (Candolle) Robinson	Dahlberg daisy	Nat.	R	
<i>Eclipta prostrata</i> (L.) L.	false daisy	Nat.	--	(2)
<i>Emilia fosbergii</i> Nicolson	<i>pualele</i>	Nat.	--	(1,2)
<i>Flaveria trinerva</i> (Spreng.) C. Mohr	---	Nat.	U	
<i>Lactuca serriola</i> L.	prickly lettuce	Nat.	U	
<i>Pluchia carolinensis</i> (Jacq.) G. Don	sourbush	Nat.	C3	
<i>Pluchia X fosbergii</i> Cooperr. & Galang	---	Nat.	U	
<i>Pluchea indica</i> (L.) Less.	Indian fleabane	Nat.	O	
<i>Sonchus oleraceus</i> L.	sow thistle	Nat.	C	
<i>Tridax procumbens</i> L.	coat buttons	Nat.	R	
<i>Verbesina encelioides</i> (Cav.) Benth. & Hook.	golden crown-beard	Nat.	A3	
<i>Xanthium strumarium</i> L.	<i>kikiana</i> , cockleburr	Nat.	O	

Table 2 (continued).

<i>Species listed by family</i>	<i>Common name</i>	<i>Status</i>	<i>Abundance</i>	<i>Notes</i>
BORAGINACEAE				
<i>Heliotropum currasavicum</i> L.	seaside heliotrope	Ind.	U	
<i>Heliotropum procumbens</i> Mill.	---	Nat.	C	
CAPPARACEAE				
<i>Cleome gynandra</i> L.	wild spider flower	Nat.	--	(1,2)
CARICACEAE				
<i>Carica papaya</i> L.	papaya	Nat.	R	(3)
CARYOPHYLLACEAE				
<i>Spergularia marina</i> (L.) Griseb.	saltmarsh sand spurry	Nat.	R1	
CHENOPODIACEAE				
<i>Atriplex semibaccata</i> R. Br.	Australian saltbush	Nat.	--	(1,2)
<i>Atriplex suberecta</i> Verd.	---	Nat.	A	
<i>Chenopodium murale</i> L.	'aheahea	Nat.	O3	
<i>Salsola tragus</i> L.	tumbleweed	Nat.	O2	
CONVOLVULACEAE				
<i>Convolvulus arvensis</i> L.	field bindweed	Nat.	--	(1)
<i>Ipomoea indica</i> (J. Burm.) Merr.	koali'awa	Ind.	R	
<i>Ipomoea obscura</i> (L.) Ker-Gawl.	---	Nat.	U2	
<i>Ipomoea triloba</i> L.	little bell	Nat.	U2	
<i>Jacquemontia ovalifolia</i> (Choisy) H. Hallier	pa'u-o-Hi'iaka	Ind.	--	(2)
<i>Merremia aegyptia</i> (L.) Urb.	hairy merremia	Nat.	U	
CUCURBITACEAE				
<i>Coccinia grandis</i> (L.) Voigt	scarlet-fruited gourd	Nat.	--	(2)
<i>Cucumis dipsaceus</i> Ehrenb. Ex. Spach	teasel gourd	Nat.	R	
<i>Momordica charantia</i> L.	balsam pear	Nat.	--	(1,2)
<i>Sicyos pachycarpus</i> Hook & Arnott.	kupala	End.	O	
EUPHORBIACEAE				
<i>Chamaesyce hirta</i> (L.) Millsp.	garden spurge	Nat.	U	
<i>Chamaesyce hypericifolia</i> (L.) Millsp.	graceful spurge	Nat.	U2	
<i>Chamaesyce hyssopifolia</i> (L.) Small	---	Nat.	--	(1)
<i>Chamaesyce prostrata</i> (Aiton) Small	prostrate spurge	Nat.	--	(1,2)
<i>Euphorbia cyathophora</i> J.A. Murray	Mexican fire plant	Nat.	--	(2)
<i>Euphorbia graminea</i> Jacq.	---	Nat.	--	(2)
<i>Euphorbia heterophylla</i> L.	kaliko	Nat.	R	
<i>Ricinus communis</i> L.	castor bean	Nat.	U2	
FABACEAE				
<i>Acacia farnesiana</i> (L.) Willd.	klu	Nat.	R	
<i>Chamaecrista nictitans</i> (L.) Moench	partridge pea	Nat.	--	(2)

Table 2 (continued).

Species listed by family	Common name	Status	Abundance	Notes
<i>Crotalaria incana</i> L.	fuzzy rattlepod	Nat.	U	
<i>Desmanthus virgatus</i> (L.) Willd.	virgate mimosa	Nat.	O	
<i>Leucaena leucocephala</i> (Lam.) deWit	<i>koa haole</i>	Nat.	AA	
<i>Erythrina</i> cf. <i>crista-galli</i> L.	coral tree	Orn.	R	(3)
<i>Indigofera spicata</i> Forssk.	creeping indigo	Nat.	--	(1)
<i>Macropitilium atropurpureum</i> (DC) Urb.	---	Nat.	R3	
<i>Macropitilium lathyroides</i> (L.) Urb.	cow pea	Nat.	--	(1,2)
<i>Pithecelobium dulce</i> (Roxb.) Benth.	' <i>opiuma</i>	Nat.	--	(1,2)
<i>Prosopis pallida</i> (Humb. & Bonpl. ex Willd.) Kunth	<i>kiawe</i>	Nat.	C	
<i>Senna occidentalis</i> (L.) Link	coffee senna	Nat.	U2	
LAMIACEAE				
<i>Leonotis nepetifolia</i> (L.) R. Br.	lion's ear	Nat.	C	
LAURACEAE				
<i>Cassytha filiformis</i> L.	<i>kauna'oa</i>	Ind.	--	(2)
MALVACEAE				
<i>Abutilon grandifolium</i> (Willd.) Sweet	hairy abutilon	Nat.	U	
<i>Malva parviflora</i> L.	cheese weed	Nat.	--	(2)
<i>Malvastrum coromandelianum</i> (L.) Garcke	false mallow	Nat.	O	
<i>Sida ciliaris</i> L.	---	Nat.	U	
<i>Sida fallax</i> Walp.	' <i>ilima</i>	Ind.	O2	
<i>Sida rhombifolia</i> L.	Cuba jute	Nat.	--	(1,2)
<i>Sida spinosa</i> L.	prickly sida	Nat.	O	
MELIACEAE				
<i>Melia azedarach</i> L.	Chinaberry	Nat.	--	(2)
MENISPERMACEAE				
<i>Cocculus trilobus</i> (Thunb.) DC	<i>huehue</i>	Ind.	--	(1)
MORACEAE				
<i>Ficus microcarpa</i> L. f.	Chinese banyan	Nat.	--	(2)
MORINGACEAE				
<i>Moringa oleifera</i> Lam.	horseradish tree	Orn.	O	(3)
MYOPORACEAE				
<i>Myoporum sandwicense</i> A. Gray	<i>naio</i>	Ind.	--	(2)
NYCTAGINACEAE				
<i>Boerhavia coccinea</i> Mill.	false <i>alena</i>	Nat.	U1	
PASSIFLORACEAE				
<i>Passiflora foetida</i> L.	running pop	Nat.	U	
PLANTAGINACEAE				
<i>Plantago major</i> L.	common plantain	Nat.	--	(2)
POLYGONACEAE				
<i>Antigonon leptopus</i> Hook. & Arnott	Mexican creeper	Nat.	R2	

Table 2 (continued).

Species listed by family	Common name	Status	Abundance	Notes
<i>Coccoloba uvifera</i> (L.) L.	sea grape	Orn.	--	(2)
PORTULACACEAE				
<i>Portulaca oleracea</i> L.	pigweed	Nat.	--	(1,2)
SOLANACEAE				
<i>Capsicum annuum</i> L.	chili pepper	Nat.	--	(2)
<i>Datura stramonium</i> L.	Jimson weed	Nat.	U	
<i>Nicandra physalodes</i> (L.) Gaertn.	apple of Peru	Nat.	U	
<i>Nicotiana glauca</i> R.C. Graham	tree tobacco	Nat.	C	
<i>Nicotiana tabacum</i> L.	tobacco	Nat.	R1	(4)
<i>Physalis angulata</i> L.	---	Nat.	--	(2)
<i>Solanum americanum</i> Mill.	popolo	Ind.	U2	
<i>Solanum lycopersicum</i> var. <i>cerasiforme</i> (Dunal) Spooner, G Anderson, & Jansen	cherry tomato	Nat.	U2	
<i>Solanum seaforthianum</i> Andr.	---	Nat.	--	(2)
STERCULIACEAE				
<i>Waltheria indica</i> L.	'uhaloa	Ind.	O	
VERBENACEAE				
<i>Lantana camara</i> L.	lantana	Nat.	--	(2)
<i>Verbena litoralis</i> Kunth	owi	Nat.	--	(2)
ZYGOPHYLLACEAE				
<i>Tribulus terrestris</i> L.	puncture vine	Nat.	--	(1)
MONOCOTYLEDONES				
AGAVACEAE				
<i>Cordyline fruticosa</i> L.	ti	Pol.	--	(1,3)
ARACACEAE				
<i>Cocos nucifera</i> L.	coconut	Pol.	R	(3)
COMMELINACEAE				
<i>Commelina benghalensis</i> L.	hairy honohono	Nat.	--	(2)
<i>Commelina diffusas</i> N.L. Burm.	honohono	Nat.	--	(2)
CYPERACEAE				
<i>Cyperus rotundus</i> L.	nut grass	Nat.	R3	
MUSACEAE				
<i>Musa X paradisiaca</i> L.	banana	Pol.	R	(2)
POACEAE				
<i>Cenchrus ciliaris</i> L.	buffelgrass	Nat.	AA	
<i>Cenchrus echinatus</i> L.	sandbur	Nat.	R3	
<i>Chloris barbata</i> (L.) Sw.	swollen fingergrass	Nat.	AA	

Table 2 (continued).

Species listed by family

<i>Species listed by family</i>	<i>Common name</i>	<i>Status</i>	<i>Abundance</i>	<i>Notes</i>
<i>Cynodon dactylon</i> (L.) Pers.	Bermuda grass	Nat.	--	(2)
<i>Digitaria insularis</i> (L.) Mez ex Ekman	sourgrass	Nat.	R	
<i>Eleusine indica</i> (L.) Gaertn.	beach wiregrass	Nat.	U	
<i>Eragrostis tenella</i> (L.) P. Beauv. ex Roem. & Schult.	lovegrass	Nat.	O3	
<i>Leptochloa uninervia</i> (K Presl.) Hitchc. & Chase	sprangletop	Nat.	U3	
<i>Melinis repens</i> (Willd.) Zizka	Natal redtop	Nat.	O	
<i>Panicum maximum</i> Jacq.	Guinea grass	Nat.	C	
<i>Saccharum officinarum</i> L.	sugar cane	Pol.	--	(2,3)
<i>Setaria verticillata</i> (L.) P. Beauv.	bristly foxtail	Nat.	O3	
<i>Sporobolus</i> cf. <i>diander</i> (Retz.) P. Beauv.	Indian dropseed	Nat.	O3	
<i>Urochloa mutica</i> (Forssk.) T.Q. Nguyen	para grass	Nat.	R2	
indet. grass	large with hairy culms	Nat.	R	

Legend to Table 2

STATUS = distributional status for the Hawaiian Islands:	
end. =	endemic; native to Hawaii and found naturally nowhere else.
ind. =	indigenous; native to Hawaii, but not unique to the Hawaiian Islands.
nat. =	naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.
orn. =	exotic, ornamental or cultivated; plant not naturalized (not well-established outside of cultivation).
pol. =	Polynesian introduction before 1778.
ABUNDANCE = occurrence ratings for plants by area:	
R - Rare	seen in only one or perhaps two locations.
U - Uncommon	seen at most in several locations
O - Occasional	seen with some regularity
C - Common	observed numerous times during the survey
A - Abundant	found in large numbers; may be locally dominant.
AA - Very abundant	abundant and dominant; defining vegetation type.
Numbers following an occurrence rating indicate clusters within the survey area. The ratings above provide an estimate of the likelihood of encountering a species within the specified survey area; numbers modify this where abundance, where encountered, tends to be greater than the occurrence rating:	
	1 - several plants present
	2 - many plants present
	3 - locally abundant
NOTES:	(1) - Previously identified from project area in David & Guinther (2005)
	(2) - Previously identified from project area in Char & Associates (1989)
	(3) - Probably cultivated in this area
	(4) - No fruit or flowers

Discussion

Mammalian Resources

A one-time survey can not provide a total picture of the wildlife utilizing any given area. Certain species will not be detected for one reason or another. Seasonal variations in populations coupled with seasonal usage and availability of resources will cause different usage patterns throughout a year or, in fact, over a number of years. Coupling the results of a one-time survey with the results of previous surveys conducted in similar habitat

within the general project area, greatly enhances the understanding of the faunal makeup of site.

The findings of the mammalian survey are consistent with the findings of at least two other survey conducted on portions of the proposed project site (Bruner 1989, Guinther and David 2005) and with several others faunal surveys conducted on lands in the general vicinity of the subject property in the recent past (David, 2000, 2001, 2004, 2005a, 2005b, 2006, David and Guinther 2005, 2006).

Although no rodents were detected during the course of this survey, it is likely that roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*), European house mice (*Mus domesticus*) and possibly Polynesian rats (*Rattus exulans hawaiiensis*) use resources within the general project area. All of these introduced rodents are deleterious to remaining native ecosystems and the native floral and faunal species that are dependant on them for their survival.

Avian Resources

The findings of the avian survey are consistent with the findings of at least two other survey conducted on portions of the proposed project site (Bruner 1989, Guinther and David 2005) and with several others faunal surveys conducted on lands in the general vicinity of the subject property in the recent past (David, 2000, 2001, 2004, 2005a, 2005b, 2006, David and Guinther 2005, 2006).

As previously mentioned we recorded four native avian species, including Black-necked Stilt, which is listed as endangered under both Federal and State of Hawai'i endangered species statutes. We recorded a total of four Black-necked Stilts, three birds were first seen to flush off of a small, water filled depression within the coral mining operation quarry. As we walked southwest towards the Chevron tank farm two of the birds followed us, often circling and calling vociferously. These two birds followed us all the way to Malakole Road, a distance of some 1000-meters from where they were initially seen. The aggressive behavior exhibited by the stilts could have represented defense of a nest, eggs, or chicks, conversely the behavior could simply have been a reaction to our presence, stilts are extremely vocal birds and easily flush when disturbed. We conducted an extensive search of the three mining scrapes present on the site in an effort to detect any active stilt nests. None were found, nor were any chicks or sub-adult birds, or nests found during Bruner's July (1989) survey, or our August 2005 survey of the same area (David and Guinther 2005). The bulk of stilts nest between February and Mid-August, thus if active nesting was going on the site it is probable that we would have detected that activity during the 1989, 2005 or the 2006 surveys of the site. Stilt are extremely opportunistic, and rapidly explore any ephemeral standing water, they have been seen along the harbor, within the green waste dump, and are regularly seen, and nest within the Chevron tank farm located to the southwest of the site.

Of the three other native avian species recorded, one (the Black-crowned Night-Heron) is an indigenous resident species commonly encountered foraging or roosting at wetland features such as man-made canals, stream, ponds, lakes and just about any area that holds water for a reasonable amount of time. The other two native species recorded, Pacific Golden-Plover and Ruddy Turnstone, are common indigenous migratory shorebirds that nest in the high Arctic in the late spring and summer, returning to Hawai'i and the tropical Pacific Islands during fall and winter months. The remaining 15 species detected during the course of this survey are considered to be alien to the Hawaiian Islands.

During the course of this survey we did not see one listed species Hawaiian Duck (*Anas wyvilliana*) that were seen on the most recent previous survey of portions of the subject property. Additionally, we recorded two species on this survey, Cattle Egret, and House Sparrow (*Passer domesticus*), which were not record during the 2005 survey (Table 1), (David and Guinther 2005).

From an avian perspective there is nothing unique about the habitat present on the subject property, and none of the habitat present on the site is important habitat for any listed avian or mammalian species currently known from the Island of O'ahu.

Botanical Resources

A one-time survey can not provide a total picture of the botanical makeup of any given area. Certain species will not be detected for one reason or another. Seasonal variations in populations coupled with seasonal usage and availability of resources will cause different usage patterns throughout a year or, in fact, over a number of years. We surveyed the site in May 2006, it followed on a wet period and we recorded most of the annual species that one would expect from the site. If another survey was conducted between November and January, typically the wetter months, additional species, would be recorded, though the majority of these would likely be weedy alien species. This site has been surveyed for botanical resources by Char in August (1989), David and Guinther August (2005), and by this survey which was conducted in May (2006).

No ferns or fern allies were observed during the plant survey. The dry climate and reasonably well-drained calcareous soils are not conducive to supporting most fern species found in Hawai'i. The flora of the project area is comprised of flowering plants and overwhelmingly dominated by alien plant species. A total of 121 species of plants are listed in Table 2. Of these, 73 were recorded during the survey on May 4, and another 48 species, while not observed in May, were previously recorded from the site by either David and Guinther (2005; 19 species) or from the same general area by Char & Associates (1989; 40 species), (Table 2).

Sixteen of the species recorded were known to occur in the Hawaiian Islands before the arrival of James Cook in 1778. Four of these are considered to be introductions made by the earlier Polynesian settlers, leaving 12 species (10%) as plants native to the Hawaiian Islands. Of these 12, only one is an endemic, and the remaining 10 are indigenous

species. The one endemic species recorded, *kūpala* (*Sicyos pachycarpus*), is a vine that is a seasonal annual and fairly common in leeward coastal areas. The indigenous native species recorded are also common lowland plants found in the dry leeward and coastal sites throughout the Pacific Islands. If we consider the abundance estimates for these native species, all but *kūpala* and *'ilima* (*Sida fallax*) are rare or uncommon within the survey area. Both of the latter were mostly observed in the Kiawe/Bufelgrass association, comprising only about 10% of the project area. Thus, in terms of biomass as well as number of species, native plants are a mostly minor component of the vegetation.

Conclusions

Faunal Resources

The presence of endangered Black-necked Stilts on the property will likely require that the project consult with the USFWS under the endangered species act of 1973, as amended to determine if the proposed action will result in a deleterious impact to this listed species.

It is not expected that the modification of the habitat currently found on the site or the construction of the proposed industrial park will have a negative impact on any avian or mammalian species currently listed as endangered, threatened, or that are currently proposed for listing under either federal or State of Hawai'i endangered species statutes (Federal Register, 1999, 2005).

Botanical Resources

The results of the botanical survey indicate there are no special concerns or legal constraints related to botanical resources in the project area. Although the 'Ewa Plain is known to harbor several rare and, in some cases, federally listed species of Hawaiian native plants (see Char and Balakrishnan, 1979), these species are not present in the highly disturbed quarry and dredged spoil disposal areas around Barbers Point Deep Draft Harbor and former agriculture lands further inland that comprise the Kapolei Harborside Center project. No plant species listed as endangered, threatened, or that are currently proposed for listing under either federal or State of Hawai'i endangered species statutes are known from the project site (Federal Register, 1999, 2005).

Glossary

Alien - Introduced to Hawai'i by humans

Crepuscular - Twilight hours

Domesticated - Feral species, not considered established in the wild on the Island of O'ahu

Endangered - Listed and protected under the ESA as an endangered species

Endemic - Native and unique to the Hawaiian Islands

Incidental observation - A species not counted during station counts, but seen within the project area.

Indigenous - Native to the Hawaiian Islands, but also found elsewhere naturally

Nocturnal - Night-time, after dark

Ruderal - Disturbed, rocky, rubbishy areas, such as old agricultural fields and rock piles

Threatened - Listed and protected under the ESA as a threatened species

DLNR - Hawaii State Department of Land & Natural resources

TMK - Tax Map Key

Literature Cited

- American Ornithologist's Union. 1998. *Check-list of North American Birds*. 7th edition. American Ornithologist's Union. Washington D.C. 829pp.
- _____. 2000. Forty-second supplement to the American Ornithologist's Union *Check-list of North American Birds*. *Auk* 117:847-858
- Banks, R. C., C. Cicero, J. L. Dunn, A. W. Kratter, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2002. Forty-third supplement to the American Ornithologist's Union *Check-list of North American Birds*. *Auk* 119:897-906.
- _____. 2003 Forty-fourth supplement to the American Ornithologist's Union *Check-list of North American Birds*. *Auk* 120:923-931.
- _____. 2004 Forty-fifth supplement to the American Ornithologist's Union *Check-list of North American Birds*. *Auk* 121:985-995.
- _____. 2005 Forty-sixth supplement to the American Ornithologist's Union *Check-list of North American Birds*. *Auk* 122:1031-1031.
- Bruner, P. L. 1989. Survey of the Avifauna and Feral Mammals at the Proposed Campbell Commercial-Industrial Site, Ewa, Oahu. Prepared for: William E. Wanket, Inc.
- Char & Associates. 1989. Botanical Survey Campbell Estate Commercial-Industrial Project 'Ewa District, Island of O'ahu. Prepared for: William E. Wanket, Inc.
- Char, W.P. and N. Balakrishnan. 1979. 'Ewa Plains Botanical Survey. Prep. for U.S. Fish and Wildlife Service. Contract No. 14-16-0001-78171.
- David, R. E. 2000. Faunal Survey of Avian and Mammalian Species along the Proposed Leeward Bikeway Project, O'ahu, Hawaii. Prepared for: AECOS Inc.
- _____. 2001. A Survey of Avian and Terrestrial Mammalian Species for the HECO Fuel Pipeline: Barbers Point to Wai'au Project, O'ahu, Hawai'i. Prepared for: Planning Solutions, Inc., and Hawaiian Electric Company, Inc.
- _____. 2004. An Avian Assessment of the Proposed Kalo'i Gulch Drainageway Improvements at One'ula Beach Park Project. Prepared for: Planning Solutions, Inc. & Haseko (Ewa), Inc.
- _____. 2005a. A Survey of Avian and Terrestrial Mammalian Species for the Kamokila Boulevard Extension Project, 'Ewa District, O'ahu, Hawai'i. Prepared for: Kimura International, and the State of Hawai'i Department of Transportation, Highways Division (HDOT).

-
- David, R. E. 2005b. A Survey of Avian and Terrestrial Mammalian Species for the Proposed Interstate H-1 Addition and Modification of Highway Accesses, Pālalāi Interchange and Makakilo Interchange Project, 'Ewa District, O'ahu, Hawai'i. Prepared for: Engineering Concepts, Inc. & The State of Hawai'i, Department of Transportation, Highways Division.
- David, R. E., and E. Guinther. 2005. A Survey of Botanical, Avian and Mammalian Resources, Hawaiian Electric Generating Station and Transmission Additions Project Site, Campbell Industrial Park, 'Ewa District, O'ahu, Hawai'i. Prepared for: Planning Solutions, Inc. & Hawaiian Electric Company.
- _____. 2006. A Survey of Botanical, Avian and Mammalian Resources on the Makaīwa Hills Project Site, 'Ewa District, O'ahu, Hawai'i. Prepared for: Group 70 International, and The Estate of James Campbell.
- Department of Land and Natural Resources (DLNR). 1998. Indigenous Wildlife, Endangered And Threatened Wildlife And Plants, And Introduced Wild Birds. Department of Land and Natural Resources. State of Hawaii. Administrative Rule §13-134-1 through §13-134-10, dated March 02, 1998.
- Federal Register 1999a. Department of the Interior, Fish and Wildlife Service, Endangered and Threatened Wildlife and Plants. 50CFR 17:11 and 17:12 – December 3, 1999
- _____. 2005. Department of the Interior, Fish and Wildlife Service, 50 CFR 17. Endangered and Threatened Wildlife and Plants. Review of Species That Are Candidates or Proposed for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petition; Annual Description of Progress on Listing Actions. Federal Register, 70 No. 90 (Wednesday, May 11, 2005): 24870-24934.
- Pukui, M. K., S. H. Elbert, and E. T. Mookini 1976. *Place Names of Hawaii*. University of Hawaii Press. Honolulu, Hawai'i. 289 pp.
- Staples, G. W., and D. R. Herbst 2005. *A Tropical Garden Flora: Plants Cultivated in the Hawaiian Islands and Other Tropical Places*. Bishop Museum Press.
- Tomich, P.Q. 1986. *Mammals in Hawaii*. Bishop Museum Press. Honolulu, Hawaii. 375 pp.
- Wagner, W.L., D.R. Herbst, S.H. Sohmer 1990. *Manual of the Flowering Plants of Hawai'i*. University of Hawaii Press, Honolulu, Hawaii 1854 pp.
- Wagner, W.L. and D.R. Herbst. 1999. *Supplement to the Manual of the flowering plants of Hawai'i*, pp. 1855-1918. In: Wagner, W.L., D.R. Herbst, and S.H. Sohmer, *Manual of the flowering plants of Hawai'i. Revised edition*. 2 vols. University of Hawaii Press and Bishop Museum Press, Honolulu.