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**Kaukonahua Solar Farm Project
Biological Survey Report**

Project # 4432-01

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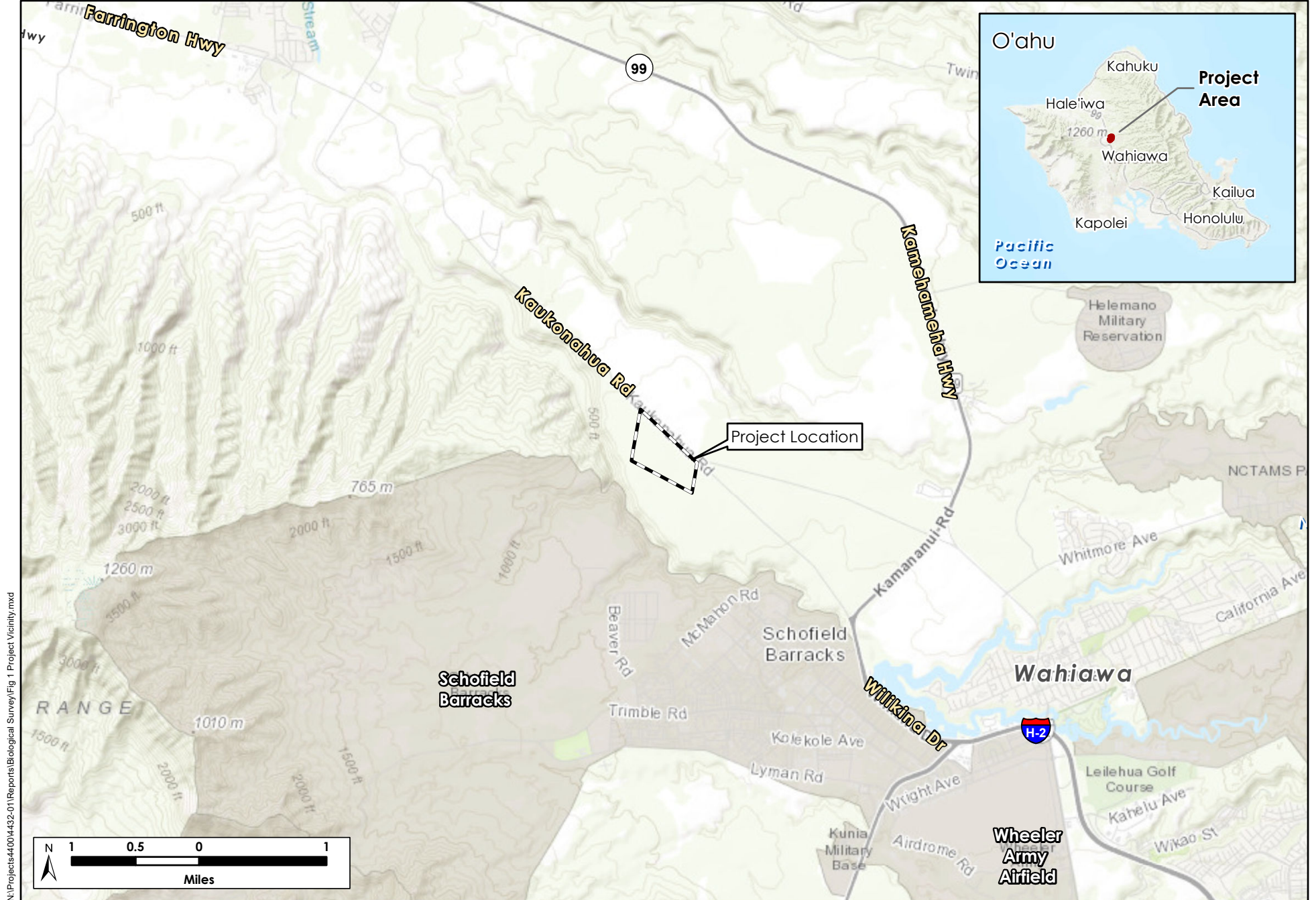
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Section 1.0 Project Description and Background

Melink Solar Development is proposing to build a 5-6 megawatt (MW) AC, 10–12 MW DC solar photovoltaic project paired with up to 25 MW hours (MWh) of battery storage (the Project) in Central Oahu. The proposed Kaukonahua Solar Farm Project (henceforth also referred to as the Project) would be located on the Villa Rose egg farm (TMK: (1) 6-5-002-005) along Kaukonahua Road in Waialua (Figure 1). The site was formerly part of the Dole Plantation and has been farmed for more than 70 years. The Project is being considered by the Hawaiian Electric Company (HECO) and their decision is expected in summer 2020. To facilitate community outreach immediately after HECO's decision, Melink Solar Development would like to move forward with environmental due diligence for the Project. As such, they requested that H. T. Harvey & Associates to conduct a reconnaissance-level flora and fauna study on approximately 106 acres (Biological Study Area) of the Villa Rose egg farm where the proposed Project would be situated (Figure 2).

This biological survey report presents the findings of the flora and fauna study conducted to support the environmental planning and permitting for the Project. The objectives of this biological study were to:

- Conduct a reconnaissance-level wildlife survey to detect and record the wildlife species (birds and mammals).
- Conduct a reconnaissance-level botanical survey to identify and document the vegetation communities and the plant species.
- Identify and document biological issues of concern, including the presence of any taxa that are state or federally listed as threatened or endangered, candidate species for listing, or sensitive habitats.
- Identify the potential impacts of implementing the Project and a range of conservation measures that may be considered for inclusion into the planning and design phase if any listed taxa, candidate species for listing, or sensitive habitats are found in the Biological Study Area.



N:\Projects\44004432-01\Reports\Biological Survey\Fig. 1 Project Vicinity.mxd

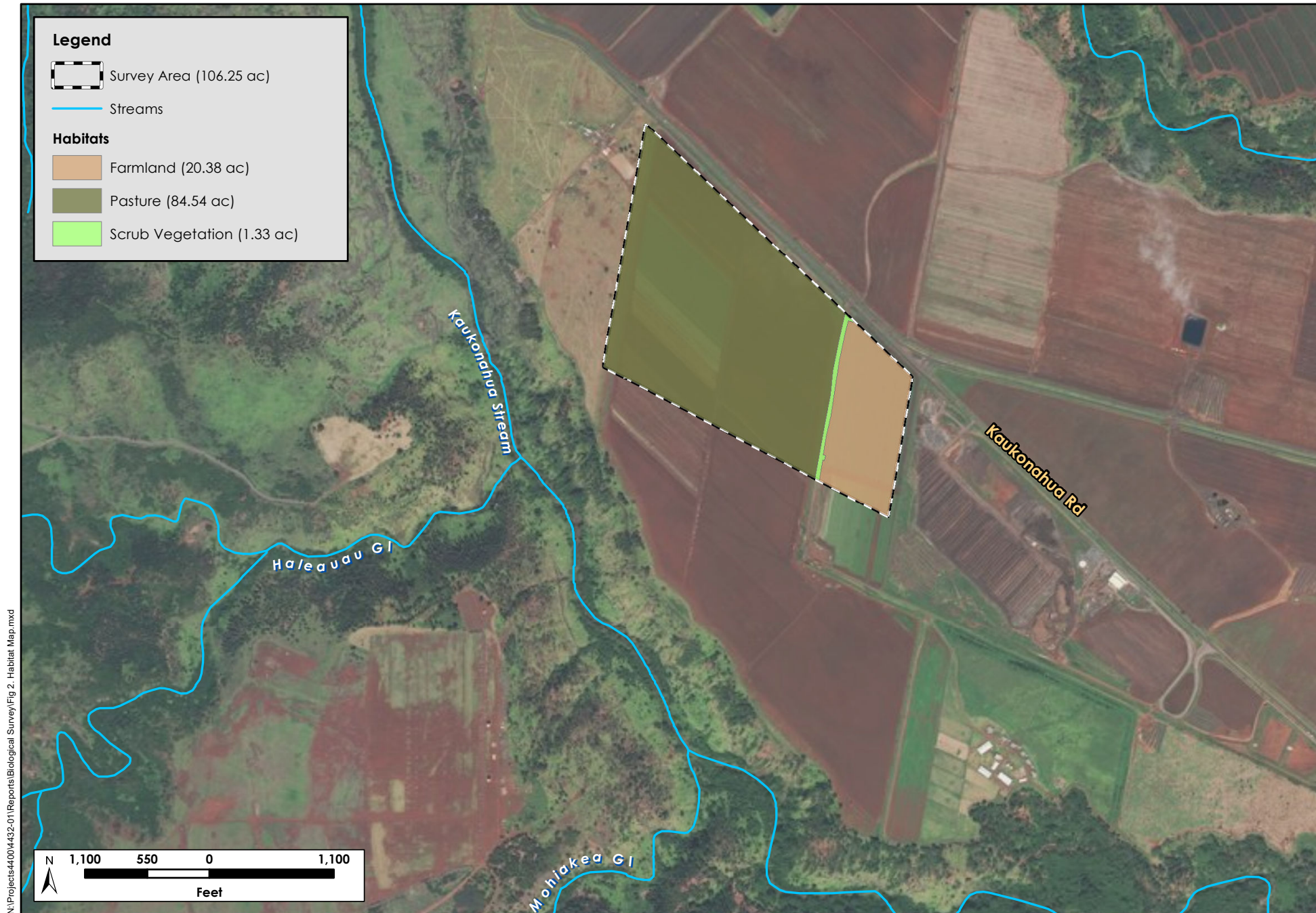


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Figure 1. Project Vicinity

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Figure 2. Habitat Map

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Section 2.0 Methods

A reconnaissance-level survey of the Biological Study Area was conducted on May 7, 2020, from 9:00 a.m. to 5:00 p.m. Sunny skies with moderate trade winds prevailed during the survey. One botanist and one wildlife biologist (hereafter referred to as biologists) conducted the survey together. The biologists walked the Biological Study Area and documented the vegetation communities, plants, birds and mammals. A handheld Global Positioning System (GPS) device preloaded with spatial data (e.g., Biological Study Area boundary) was used to navigate during the survey and record field observations. In general, rocky outcrops, shaded areas, and topographic depressions, which are more likely to support native plant species, were surveyed more extensively.

Visual or auditory detection and identification of animal signs (e.g., scat, tracks, and nests) were used to document the presence of bird and mammal species. In addition to general observations made throughout the survey, four 10-minute point counts of birds were conducted between 9:20 a.m. and 10:35 a.m. This effort included tallying all birds seen or heard by a single observer from a fixed point over a period of 10 minutes. Hawaii does not have native reptiles and amphibians. The only native terrestrial mammal, the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), is known to occur on Oahu (Tomich 1986). Protocol-level surveys to detect Hawaiian hoary bat activity in the Biological Study Area were outside the scope of this biological study.

From the Kaukonahua Road, an unpaved access road into the Biological Study Area divides it into a larger (86 acres) parcel to the west and a smaller (20 acres) parcel to the east (Figure 2). The biologists surveyed the larger parcel first.

Section 3.0 Results

3.1 Flora

The taxa recorded during the reconnaissance-level survey are indicative of the season (i.e., spring) and the environmental conditions at the time of the survey. No rare native Hawaiian plant species or taxa that are state or federally listed as threatened, endangered, or candidates for listing were observed in the Biological Study Area. The 39 plant species found in the Biological Study Area were all nonnative, introduced species (Wagner et al. 1999). Table 1 provides a list of the plant species observed and their relative abundance in the Biological Study Area.

Table 1. Plant Species Observed in the Biological Study Area

Family	Scientific Name	Common Name	Status ¹	Relative Abundance
Angiosperms – Monocots				
Poaceae	<i>Axonopus compressus</i> (Sw.) P.Beauv.	Wide leaved carpet grass	nat	C
	<i>Cenchrus echinatus</i> L.	Sandbur	nat	U
	<i>Chloris barbata</i> Sw.	Swollen finger grass	nat	C
	<i>Cynodon dactylon</i> (L.) Pers.	Bermuda grass	nat	U
	<i>Digitaria ciliaris</i> (Retz.) Koeler	Henry's crab grass	nat	U
	<i>Digitaria insularis</i> (L.) Mez ex Ekman	Sourgrass	nat	A
	<i>Urochloa maxima</i> (Jacq.) R. Webster	Guinea grass	nat	A
	<i>Melinis repens</i> (Willd.) Zizka	Natal red top	nat	U
Angiosperms – Dicots				
Acanthaceae	<i>Asystasia gangetica</i> (L.) T.Anderson	Chinese violet	nat	U
Amaranthaceae	<i>Amaranthus spinosus</i> L.	Spiny amaranth	nat	U
Asteraceae	<i>Ageratum conyzoides</i> L.	Billygoat weed	nat	C
	<i>Bidens alba</i> (L.) DC. var. <i>radiata</i> (Sch.Bip.) Ballard ex Melchert	Beggartick	nat	C
	<i>Bidens pilosa</i> L.	Spanish needle	nat	C
	<i>Calypocarpus vialis</i> Less.	Straggler daisy	nat	U
	<i>Emilia fosbergii</i> Nicolson	Pualele	nat	R
	<i>Pluchea carolinensis</i> (Jacq.) G.Don	Sourbush	nat	R
	<i>Verbesina encelioides</i> (Cav.) Benth. & Hook.	Golden crown beard	nat	A
	<i>Xanthium strumarium</i> L. var. <i>canadense</i> (Mill.) Torr. & A.Gray	Cocklebur	nat	C

Family	Scientific Name	Common Name	Status ¹	Relative Abundance
Boraginaceae	<i>Heliotropium procumbens</i> Mill. var. <i>depressum</i> (Cham.) Fosberg	Fourspike heliotrope	nat	U
Brassicaceae	<i>Lepidium virginicum</i> L.	Peppergrass	nat	C
Chenopodiaceae	<i>Dysphania carinata</i> (R.Br.) Mosyakin & Clemants	Chenopodium	nat	U
Convolvulaceae	<i>Ipomoea obscura</i> (L.) Ker Gawl.	Obscure morning glory	nat	C
Cucurbitaceae	<i>Momordica charantia</i> L.	Bitter melon	nat	U
Euphorbiaceae	<i>Euphorbia hirta</i> L.	Hairy spurge	nat	U
	<i>Phyllanthus debilis</i> Klein ex Willd.	Niruri	nat	U
	<i>Ricinus communis</i> L.	Castor bean	nat	C
Fabaceae	<i>Crotalaria pallida</i> Aiton	Smooth rattle pod	nat	R
	<i>Desmodium incanum</i> DC.	Spanish clover	nat	U
	<i>Indigofera suffruticosa</i> L.	Upright indigo	nat	U
	<i>Macroptilium atropurpureum</i> (DC.) Urb.	Vining cow pea	nat	U
	<i>Mimosa pudica</i> L. var. <i>unijuga</i> (Duchass. & Walp.) Griseb.	Sensitive plant	nat	U
	<i>Senna occidentalis</i> (L.) Link.	Coffee senna	nat	R
Malvaceae	<i>Abutilon</i> sp.	Abutilon	nat	R
	<i>Sida rhombifolia</i> L.	Cuban jute	nat?	C
Meliaceae	<i>Azadirachta indica</i> A.Juss.	Neem	nat	R
Plantaginaceae	<i>Plantago lanceolata</i> L.	Narrow leaf plantain	nat	U
Solanaceae	<i>Solanum torvum</i> Sw.	Turkeyberry	nat	C
Verbenaceae	<i>Lantana camara</i> L.	Lantana	nat	U
	<i>Verbena litoralis</i> Kunth	Vervain	nat	C

¹ **Status Notes:** nat = naturalized = introduced or alien (all those plants brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact [i.e., Cook's arrival in the islands in 1778]).

Qualitative Relative Abundance of Observed Species in Study Area: A = abundant—forming a major part of the vegetation in the Biological Study Area. C = common—widely scattered throughout the Biological Study Area or locally abundant in a portion of it. U = uncommon—scattered sparsely throughout the Biological Study Area or occurring in a few small patches. R = rare—only a few isolated individuals in the Biological Study Area.

Additional Notes: This checklist is an inventory of all the plant species observed on May 7, 2020, in the Biological Study Area of the Kaukonahua Solar Farm Project. The plant names are arranged alphabetically by family, then by species. The taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (1999); recent name changes are those recorded in Wagner and Herbst (1999) and Wagner et al. (2012).

The vegetation in the larger parcel that is west of the access road can be described as pasture (Figures 2 and 3). The terrain was flat and the vegetation in the pasture was relatively homogenous. It was dominated with grass species such as sourgrass (*Digitaria insularis*), guinea grass (*Megathyrsus maximus*), and radiate finger grass (*Chloris radiata*) (Figure 3). Several herbaceous weed species such as vervain (*Verbena litoralis*), Spanish needle (*Bidens pilosa*), billygoat weed (*Ageratum conyzoides*), pepperweed (*Lepidium virginicum*), and spiny amaranthus (*Amaranthus spinosus*) were common in the pasture. Mower tracks were visible in the pasture, indicating that it is periodically mowed. At the time of the survey, vegetation in the pasture was less than 1 foot in height. At five different locations, old water pumps were found in the pasture habitat; possibly remnant from when the land was farmed for pineapple. Tall sourgrass was conspicuous around pumps, presumably because the mower cannot be operated so close to them. An earthen berm, about 5 feet high, ran parallel to the western border of the pasture. Grasses on the slopes of this berm were also unmowed and tall. A dirt road lined with tall guinea grass and castor bean (*Ricinus communis*) shrubs formed the eastern border of the pasture.

The vegetation in the smaller eastern parcel of the Biological Study Area can be described as farmland. Most of the central portion of this farmland was ploughed but fallow, and covered with seedlings of herbaceous weeds such as spiny amaranth, beggartick (*Bidens alba* var. *radiata*), and Cuban jute (*Sida rhombifolia*) (Figure 4). The surrounding vegetation in the un-ploughed areas in the northern part was mostly dominated by golden crown beard (*Verbesina encelioides*), spiny amaranth, and beggartick. The southern part of the farmland was dominated by relatively taller and denser stands of golden crown beard and guinea grass, as well as turkeyberry shrubs (*Solanum torvum*) and cocklebur (*Xanthium strumarium*) (Figure 5).

There is a dense row of scrub vegetation (about 1.3 acres) which lines the access road between the two parcels. This vegetation type mostly consists of tall, unmowed guinea grass and castor bean shrubs, with vining cow pea (*Macroptilium atropurpureum*) draped on the shrubs (Figure 6).



Figure 3. Pasture Vegetation in the Larger Western Portion of the Biological Study Area was Dominated by (Mowed) Sourgrass (*Digitaria insularis*) and Guinea Grass (*Urochloa maxima*).



Figure 4. Ploughed but Fallow Field in the Central Part of the Farmland Vegetation.



Figure 5. Vegetation in the Southern Portion of the Farmland was Dominated by Guinea grass (*Urochloa maxima*), Golden Crown Beard (*Verbesina encelioides*), and Turkeyberry (*Solanum torvum*).



Figure 6. Scrub Vegetation along the Access Road into the Biological Study Area was Dominated by Guinea Grass (*Urochloa maxima*) and Castor Bean (*Ricinus communis*) Shrubs.

3.2 Fauna

Point count surveys in the Biological Study Area identified 211 individual birds from 10 species. All observed bird species are nonnative, introduced, or alien to Hawaii. Chestnut munia (*Lonchura atricapilla*) was the most abundant species in the Biological Study Area (Table 2) and was seen in the pasture habitat in flocks of up to 60 individuals. Other common species observed were common myna (*Acridotheres tristis*), cattle egret (*Bubulcus ibis*), common waxbill (*Estrilda astrild*), black francolin (*Francolinus francolinus*), red-crested cardinal (*Paroaria coronata*), and zebra dove (*Geopelia striata*). Two small flocks of common waxbills were also detected in the pasture habitat. Red-vented bulbuls (*Pycnonotus cafer*) were spotted among the scrub vegetation along the access road between the pasture and the farmland vegetation. Black francolin calls were often heard when surveying the pasture habitat. One species seen in the Biological Study Area is protected under the federal Migratory Bird Treaty Act (MBTA): cattle egret, but also listed as an injurious species in the State of Hawaii. The red-vented bulbul (*Pycnonotus cafer*) and spotted dove (*Streptopelia chinensis*) seen in the Biological Study Area are also on the state list of injurious wildlife species (DLNR 2015) and are known to be harmful to agriculture, aquaculture, or indigenous wildlife or plants or to constitute a nuisance or health hazard: cattle egret, red-vented bulbul, and the spotted dove (*Streptopelia chinensis*).

All mammal species observed in the Study Area were domesticated animals (Table 3). A large herd of cattle (*Bos taurus*), 8–10 domestic horses (*Equus caballus*), four donkeys (*Equus asinus*), and one domestic goat (*Capra aegagrus hircus*) were seen grazing in the northern part of the pasture (Figure 7). There was a herd of bulls present in the farmland vegetation.

Table 2. Bird Species Observed in the Study Area

Scientific Name	Common Name	Status	Number Observed on Point Count Stations (n=6)	Number of Stations Occupied (n = 6)	Qualitative Relative Abundance
<i>Acridotheres tristis</i>	Common myna	X	9	2	Common
<i>Bubulcus ibis</i>	Cattle egret	X, IW, M	6	3	Common
<i>Estrilda astrild</i>	Common waxbill	X	22	2	Common
<i>Francolinus francolinus</i>	Black francolin	X	8	4	Common
<i>Geopelia striata</i>	Zebra dove	X	9	4	Common
<i>Lonchura atricapilla</i>	Chestnut munia	X	144	3	Abundant
<i>Paroaria coronata</i>	Red-crested cardinal	X	4	3	Uncommon
<i>Pternistis erckelii</i>	Erckel's francolin	X	2	2	Uncommon
<i>Pycnonotus cafer</i>	Red-vented bulbul	X, IW	4	1	Uncommon
<i>Streptopelia chinensis</i>	Spotted dove	X, IW	3	2	Uncommon

Notes: Abundance based on the average number of individuals observed per count station, averaged across all point count stations, as follows:

Abundant – average ≥ 5 calls/minute or ≥ 5 individuals observed per station

Common – average 3–5 calls/minute or 3–5 individuals observed per station

Uncommon – average 1 - 3 calls/minute or 1 - 3 individuals observed per station

Rare – average < 1 call/minute or < 1 individual observed per station

IW = State (HAR 12-124, Exhibit 5) or Federal (18 U.S.C. 42) injurious wildlife species

X = introduced or alien (nonnative species)

M= Listed as a Migratory Bird Treaty Act Protected Species (10.13 List)

Table 3. Mammal Species Observed in the Study Area

Scientific Name	Common Name	Status	Qualitative Relative Abundance
<i>Bos taurus</i>	Cattle	X	Common
<i>Equus asinus</i>	Donkey	X	Rare
<i>Equus caballus</i>	Domestic horse	X	Common
<i>Capra aegagrus hircus</i>	Domestic goat	X	Common

X = introduced or alien (nonnative species)



Figure 7. Herd of Cattle Grazing in the Northern Part of the Pasture.

Section 4.0 Conclusions and Discussion

4.1 Flora

It is unlikely that the proposed Project to build a solar photovoltaic project on approximately 80 acres or less within the Biological Study Area would result in a substantial adverse effect on any plant species that is state or federally listed as threatened or endangered, candidate species for listing, species of concern, or rare native Hawaiian plant species. This study did not find any botanical concerns; the Biological Study Area is highly disturbed pasture and farmland, and all plants observed were nonnative, introduced species. Also, a separate study conducted by H. T. Harvey & Associates (2020), concluded that the Project is also not likely to have jurisdictional concerns as no potential wetlands or non-wetlands waters of the U.S. were found within the Biological Study Area.

H. T. Harvey & Associates recommends that the Project design specifications for revegetation of areas disturbed during construction phase include the use of native plants to the extent feasible. Potential native plants that are ecologically suitable for landscaping in mesic habitat at the Project site include koa (*Acacia koa*), hala, aalii (*Dodonaea viscosa*), kului (*Nototrichum sandwicense*), and Oahu sedge (*Carex wahuensis*). If native plants do not meet landscaping objectives, plants with a low risk of becoming invasive may be substituted. Additional information on selecting appropriate plants for landscaping can be obtained from the Plant Pono website (<http://www.plantpono.org/>).

A potential impact of implementing the Project is the introduction and spread of invasive species during the construction phase. H. T. Harvey & Associates understands that this biological study is in support of the Project's planning and design phase. Nonetheless, we recommend that the Project plan and design incorporate specifications that will result in the adoption of best management practices to minimize the introduction and spread of invasive species at the Project site. These best management practices may include the following:

- All construction equipment and vehicles should arrive at the work site for the first time in clean condition and free of: any soil; plants or plant parts, including seeds; insects, including eggs; and reptiles and amphibians, including their eggs. Similarly, all construction equipment and vehicles should also be cleaned after use on the Project site and before leaving the site.
- All materials imported to the Project site, including gravel, soil, rock, and sand, should be free of invasive plants. Invasive species found on stockpiled materials should be removed either chemically or mechanically.
- Only plants grown on Oahu should be used for landscaping purposes. If locally grown plants are unavailable, then imported plants may be used, but they should be thoroughly inspected or quarantined if necessary to ensure that they are free from invasive pests such as coqui frogs

(*Eleutherodactylus coqui*) and little fire ants (*Wasmannia auropunctata*), and invasive plant seeds and seedlings that could arrive inadvertently.

- Only weed-free seed mixtures should be used for hydroseeding and hydromulching on the Project site. A qualified botanist should inspect the seeded areas a minimum of 60 days after the hydroseed/hydromulch is applied. Any species of plant other than those intended to be in the hydroseed/hydromulch should be removed. In particular, plant species that are not known to occur on Oahu and those that are actively being controlled on the island should be removed.

It is our understanding that the Kaukonahua Solar Farm Project is also considering to graze sheep at the Project site. Most of the forage plant species suitable for sheep are non-native to Hawaii. H. T. Harvey & Associates' recommends that the Kaukonahua Solar Project only use species that are already used on Oahu as forage plants. The University of Hawaii College of Tropical Agriculture and Human Resources (CTAHR 2020) and the Hawaii Grazing Lands Coalition (Hawaii GLC 2020) are some of the available sources that could provide Project specific information with respect to suitable forage species for the Project.

4.2 Fauna

No native wildlife species were observed in the Biological Study Area. The cattle egret which is protected under the MBTA, is common on Oahu as well as on other main Hawaiian Islands. It also is listed as an injurious species in Hawaii, and may be managed as a pest. It is unlikely that the proposed Project to build a photovoltaic solar farm on approximately 80 acres or less within the Biological Study Area would have an adverse impact on the population of this species.

However, the open pasture and farmland habitats provide suitable habitat for the Hawaiian short-eared owl (or pueo) (*Asio flammeus sandwichensis*) that is state listed as endangered on Oahu (DLNR 2015). Although no pueo were observed in the Biological Study Area, it has been sighted in the vicinity of Wahiawa (Price and Cotin 2017). If pueo are seen at the Project site, H. T. Harvey & Associates recommends that Kaukonahua Solar Project consult with the Hawaii Department of Land and Natural Resources (DLNR) to assess the potential for adverse impacts on pueo from Project activities, and seek guidance on conservation measures that may need to be incorporated to avoid and minimize impacts.

Surveys to detect Hawaiian hoary bats were not conducted in support of the planning and design phase of this Project. However, Hawaiian hoary bats are known to occur on Oahu (Tomich 1986, DLNR 2015) and their presence in the Biological Study Area cannot be ruled out at the time of preparation of this report. U.S. Fish and Wildlife Service (USFWS) provides guidelines on measures to avoid and minimize impacts to Hawaiian hoary bats (USFWS 2020), during Project implementation. If Kaukonahua Solar Project determines that it is necessary to remove large trees during Project implementation, H. T. Harvey & Associates recommends that Kaukonahua Solar Project follow the USFWS guidelines, which recommend that no trees greater than 15 feet tall be trimmed or removed during the bat pupping season from June 1 to September 15; and to not use barbed

wire on any of the facility fencing (USFWS 2020). If Project activities are not compatible with this guidance, Kaukonahua Solar Project should consult with the USFWS for further guidance.

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