# ARTHROPOD SURVEY AND ASSESSMENT
# HAWAIʻI PUBLIC SHOOTING RANGE
# AT PUʻU ANAHULU,
# NORTH KONA, HAWAIʻI, HAWAIʻI

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**Prepared for**

**PBR HAWAII**
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## INTRODUCTION

A Public Shooting Range has been proposed in the makai area of the Puʻu Anahulu Game Management Area, North Kona District, Hawaiʻi. The potential site identified for further evaluation is located mauka of Queen Kaʻahumanu Highway, near mile marker 77. The site's southwest corner abuts the northeast corner of the adjacent West Hawaiʻi Sanitary landfill.

As currently proposed, the shooting complex would contain a 1000-yard competitive high power rifle range, a 100-yard high power target rifle range, a 100-yard rim-fire/air rifle range, a 50-yard bull's-eye pistol range, a 50-yard action pistol range, skeet and trap ranges, a 10-station sporting clays course, a 50-yard target archery range, and a field archery course. Office structures, a hunter education center, restrooms, and picnic and parking areas are included in the proposed complex.

The site is accessed from Queen Kaʻahumanu Highway along a 4-wheel drive jeep road, or from the landfill site. It is located on the 3,000 – 5,000 year old Kanikū Lava Flow, and consists largely of loose aʻa lava. The 640 acre site is largely devoid of vegetation. The closest inhabited structures are the Hilton Waikoloa and Waikoloa Beach Marriot resorts, several miles distant.

A 1991 survey of the avifauna and feral mammals at the proposed West Hawaiʻi sanitary landfill adjacent to the proposed shooting range found no special or unique natural resources, including no native birds. The report concluded that "Disturbed habitats of the sort found on this site are common in this region of the island. For the most part native floral and faunal communities have been replaced by introduced plants and animals."

A survey of arthropods on the proposed site of the Hawaiʻi Public Shooting Range at Puʻu Anahulu was conducted on March 15 – 17, 2012 by Dr. Gregory Brenner of Pacific Analytics, LLC. The primary objectives of the survey were to provide a general description of the arthropod fauna of the Project Site, evaluate the habitats, and search and assess the potential for threatened and endangered arthropod species as well as species of concern (DLNR 1997, Federal Register 1999, 2005).

## GENERAL SITE DESCRIPTION

The approximately 640 acre (259 hectares) Hawaiʼi Public Shooting Range at Puʻu Anahulu Site in the North Kona District on the Island of Hawaiʻi is within the parcel, TMK (3) 7-1-003:001. The Project Site ranges in elevation from about 200 ft (61 m) to about 568 ft (173 m). The Project Site consists almost entirely of aʻa lava from the Kanikū flows of Manua Loa that occurred between 3,000 and 5,000 years ago (Wolfe and Morris 1996). There are two kīpukas, on the northwest corner and northwest corners of the site that appeared to be pāhoehoe lava. These kīpukas are the only locations where soil was observed.

There are neither unique floral habitats nor unique avian and mammalian faunal habitats on the Project Site and a survey for botanical, avian, and mammalian resources found no threatened endangered, or species endemic to Hawai'i at the site (Hobdy 2012). The flora is composed of four species of plants, three non-indigenous plant species and one individual plant that is native to Hawai'i.

## SURVEY METHODS

Prior to the site visit maps and aerial photographs of the Project Site were examined to familiarize the principal investigator with the general area and locate potential arthropod habitats. After examining the maps and aerial photographs it was determined that special attention should be given to the two kīpuka areas where the botanical survey identified the largest concentration vegetation (Hobdy 2012). These areas were determined to have the best potential as native arthropod habitats.

The arthropod survey was conducted on March 15 - 17, 2012. A Staged Random-Walk survey method was used to survey the site. Vegetation was examined as it was encountered and arthropods were sampled using the following methods.

*Aerial Netting* - Flying insects were captured in aerial nets and placed into vials for immediate identification in the field. Species present were recorded in a field notebook with annotations about relative abundance and other ecological information.

*Sweep Netting* - Grasses, small shrubs and other low-lying vegetation was sampled with a sweep net. An insect net was brushed along the top of the vegetation or grass to capture insects.

*Foliage Beating* - Foliage was sampled using a beating sheet. An insect net was placed under a branch and the stem was struck with a short stick. Arthropods on the foliage were dislodged and fell onto the sheet where they were collected with an aspirator into vials for identification.

*Visual Inspection* – Plants were visually inspected for arthropods that were not collected by other methods. Time was also spent observing larger flying insects that could be identified on the wing.

*Pitfall Trapping* – Forty pitfall traps were installed throughout the Project Area during the first two days of the survey. The traps and their contents were collected on the last day of the survey.

*Light-Trapping* **-** Sampling for nocturnal insects is vital to understanding the complete faunal presence. Some insects are only active and moving around at night. Many insects have a nocturnal activity cycle to evade birds, and to locate certain food sources. Night collecting is important in environments like dry locations where insects may choose this strategy to avoid desiccation.

One battery-powered ultraviolet light trap was operated at the Project site for two nights. The traps consisted of a 3.5 gallon polypropylene bucket, a smooth surface funnel, a 22 watt Circline blacklight tube mounted on top of vanes under an aluminum lid that directs light downwards.

*Other light sampling at night* **-** Night collecting can be aided by a UV light source. An ultraviolet blacklight was placed on top of a white sheet and arthropods that were attracted to the light were collected as they are observed.

A small handheld ultraviolet blacklight was also used for additional sampling for foliage and ground-dwelling arthropods. Night sampling was limited to the 4-wheel drive road because of the danger of walking on the aʻa lava at night.

## DESCRIPTION OF THE ARTHROPOD FAUNA

Twenty-nine species of arthropods were observed during this study, 5 species endemic to Hawaiʻi, one species indigenous to Hawaiʻi, seventeen species that are non-indigenous to Hawaiʻi, and six species of unknown status.

The site is largely covered with aʻa lava and only three of the twenty-nine species were observed in this habitat away from vegetation, two species of moths and one species of fly. Plants, mostly fountain grass (*Pennisetum setaceum*), with a few scattered kiawe trees (*Prosopis pallida*), and one individual maiʻa pilo (*Capparis sandwichiana*) are sparse and provide little support to arthropods. No arthropods were seen on the fountain grass and ants were the only species found on the kiawe trees growing in the aʻa.

Four species were found on the single maiʻa pilo, one moth, white-footed ants, one blue mud dauber wasp, and plant bugs. None of these species were abundant. A few ants could be seen crawling on the stems, and the plant bugs (*Sarona* sp.) were uncommon. Only one small moth and one wasp were observed. This is likely due to the isolation of this plant, completely surrounded by aʻa lava for several hundred feet or more.

The majority to the arthropod species were found in the kīpukas associated with the more abundant vegetation there. Ants were common on the kiawe trees. The other species were uncommon, represented by fewer than 10 individuals.

No moths were captured in the two nights of light trapping. A special effort was made to find Blackburn's sphinx moth (*Manduca blackburni*), but none were observed. Blackburn's sphinx moth is one of Hawaiʻi's largest native insects (Family: Sphingidae) with a wing span of up to 12 centimeters (5 inches). Caterpillars are large and occur in two color morphs, bright green or gray. Caterpillars feed on plants in the nightshade family (Solanaceae), especially native trees in the genus *Nothocestrum* (ʻaiea), but also on non-native solanacious plants such as commercial tobacco (*Nicotiana tabacum*), tree

tobacco (*N. glauca*), eggplant (*Pseudomonas solanacearum*), tomato (*Lycopersicon esculentum*), and Jimson weed (*Datura stramonium*). These plants do not occur within the Project site and therefore it is unlikely that Blackburn's sphinx moths live on the Project site. Adult moths have been observed feeding on the nectar of several species of plants, including maiʻa pilo, but given the isolation of the single individual plant of this species on the Project site, it is unlikely adult Blackburn's sphinx moth would be found there. The sampling was conducted during a period of time when Blackburn's sphinx moths would be expected to be found, if they were present. Moths are found year-round, and are most active between January and April and again between September and November.

Pitfall traps also failed to capture any invertebrates. This is likely due to two of factors: 1) there may not have been any ground dwelling invertebrates, and 2) the difficulty placing traps in the aʻa lava. But no invertebrates were captured in pitfall traps set in soil in the kīpukas either. Therefore ground dwelling invertebrates are likely uncommon or not present on the site.

**SUMMARY OF THE ARTHROPOD FAUNA**

The arthropods species that were collected during this study would be considered typical of what would be found in lowland sites with virtually no native vegetation and only sparse vegetation surrounded by barren aʻa lava. No species were found that are locally unique to the site. Nor were any species found whose habitat would be threatened by the proposed development at the site.

The results of this arthropod survey at the proposed Hawaiʻi Public Shooting Range at Puʻu Anahulu site indicate there are no special concerns or legal constraints related to invertebrate resources in the project area. Although several species of Hawaiian endemic arthropods may occur within the Puʻu Waʻawaʻa Forest Bird Sanctuary nearly 5 miles from the Project site, and is the closest area that supports a vestige of natural habitat for endemic invertebrates, these species are not likely to be abundant in the barren, sparely vegetated land that comprise the Hawaiʻi Public Shooting Range at Puʻu Anahulu site. No invertebrate species listed as endangered, threatened, or that are currently proposed for listing under either federal or State of Hawaiʻi endangered species statutes are known to exist at the Project Site (DLNR 1997, Federal Register 1999, 2005).

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## List of Species

| Class | Order | Family | Genus | Species | Author | Status |
|---|---|---|---|---|---|---|
| Arachnida | Araneae | Salticidae | | | | unknown |
| Arachnida | Araneae | Salticidae | | | | unknown |
| Insecta | Coleoptera | Bruchidae | | | | non-indigenous |
| Insecta | Coleoptera | Coccinellidae | Hippodamia | convergens | Guerin-Meneville | non-indigenous |
| Insecta | Coleoptera | Scolytidae | Xyloborus | perforans | Wollaston | non-indigenous |
| Insecta | Diptera | Muscidae | | | | non-indigenous |
| Insecta | Diptera | Sarcophagidae | | | | non-indigenous |
| Insecta | Diptera | Syrphidae | Toxomerus | marginatus | (Say) | non-indigenous |
| Insecta | Diptera | Tipulidae | Limonia | sp. | | endemic |
| Insecta | Heteroptera | Lygaeidae | | | | non-indigenous |
| Insecta | Heteroptera | Miridae | Sarona | | | endemic |
| Insecta | Heteroptera | Nabidae | Nabis | | | endemic |
| Insecta | Hymenoptera | Anthophoridae | Xylocopa | sonorina | F. Smith | non-indigenous |
| Insecta | Hymenoptera | Apidae | Apis | mellifera | Linnaeus | non-indigenous |
| Insecta | Hymenoptera | Formicidae | Technomyrmex | albipes | (F. Smith) | non-indigenous |
| Insecta | Hymenoptera | Pompilidae | Anoplius | ventralis | Banks | non-indigenous |
| Insecta | Hymenoptera | Sphecidae | Chalybion | bengalense | (Dahlbom) | non-indigenous |
| Insecta | Hymenoptera | Vespidae | Delta | campaniforme | (Fabricius) | non-indigenous |
| Insecta | Hymenoptera | Vespidae | Odynerus | | | endemic |
| Insecta | Lepidoptera | Noctuidae | Heliocoverpa | | | endemic |
| Insecta | Lepidoptera | Nymphalidae | Danaus | plexippus | (Linnaeus) | non-indigenous |
| Insecta | Lepidoptera | Pieridae | Pieris | rapae | (Linnaeus) | non-indigenous |
| Insecta | Lepidoptera | unknown | | | | unknown |
| Insecta | Lepidoptera | unknown | | | | unknown |

| Class | Order | Family | Genus | Species | Author | Status |
|---|---|---|---|---|---|---|
| Insecta | Lepidoptera | unknown | | | | unknown |
| Insecta | Odonata | Aeshnidae | Anax | junius | (Drury) | indigenous |
| Insecta | Odonata | Coenagrionidae | Enallagma | civile | (Hagen) | non-indigenous |
| Insecta | Odonata | Libellulidae | Pantala | flavescens | (Fabricius) | non-indigenous |
| Insecta | Psocoptera | | | | | unknown |