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OFC. OF ENVIRONMENTAL QUALITY CONTROL

December 21, 2012

Memorandum

To: Gary Gill, Acting Director
Department of Health, Office of Environmental Quality Control (OEQC)

From: PJC William J. Aila, Jr., Chairperson ek for
Department of Land and Natural Resources

Subject: Request for publication of "Draft Habitat Conservation Plan for Honua'ula (Wailea 670) Kīhei, Maui" in the January 8, 2013 Environmental Notice

We respectfully request publication of the "Draft Habitat Conservation Plan for Honua'ula (Wailea 670) Kīhei, Maui," in the January 8, 2013 Environmental Notice, in accordance with applicable law Hawai'i Revised Statutes §195D-4.

Please find enclosed hard copies of the completed OEQC publication form and draft Habitat Conservation Plan (HCP) and electronic copies of the draft HCP and OEQC publication form on CD.

Please contact Division of Forestry and Wildlife, Conservation Initiatives Coordinator at Lasha.H.Salbosa@hawaii.gov or 808-587-4148 should there be any questions.

OEQC PUBLICATION FORM
THE ENVIRONMENTAL NOTICE

Project Name: Draft Habitat Conservation Plan for Honua'ula (Wailea 670) Kīhei, Maui

Island: Maui

District: Makawao

TMK: 2-1-08:056, 2-1-08:071

Permits: State Incidental Take License and Federal Incidental Take Permit

Approving Agency:
Department of Land and Natural Resources, Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325, Honolulu, HI 96815
Contact: Lasha-Lynn Salbosa, Conservation Initiatives Coordinator at Lasha.H.Salbosa@hawaii.gov or (808) 587-4148; or Acting DOFAW Wildlife Program Manager at (808) 587-0166.

Applicant:
Honua'ula Partners, LLC, P.O. Box 220, Kīhei, Hawai'i 96753.
Contact: Charlie Jencks, (808) 879-5205

Consultant:
SWCA Environmental Consultants, 1001 Bishop Street, Suite 2800, Honolulu, HI 96813
Contact: Jaap Eijzenga, (808) 548-7922 or jeijzenga@swca.com

Status: Multi-species draft habitat conservation plan 45-day public comment period starts, comments are due on **February 22, 2013**. Send comments to Approving Agency.

Summary:
The Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) is in receipt of a draft Habitat Conservation Plan (HCP) from Honua'ula Partners LLC. Pursuant to Hawaii Revised Statutes Chapter 195D, Honua'ula Partners LLC is requesting an incidental take license (ITL) from the DLNR for the take, harassment or harm to endangered or threatened species, specifically the Blackburn's sphinx moth (*Manduca blackburni*) and Nēnē (*Branta sandwichensis*) . Honua'ula Partners, LLC proposes to construct a master-planned community, including residential units, commercial spaces, and an 18-hole homeowner's golf course to provide housing and other opportunities in the district. Activities will occur on the proposed Property over the life of the project that have potential to result in the incidental take of Blackburn's sphinx moth (*Manduca blackburni*), a listed endangered species and the loss of Blackburn's sphinx moth habitat. Post-construction activities associated with the proposed 18-hole golf course could attract a second endangered species, Nēnē (*Branta sandwichensis*), resulting in the potential for incidental take of this species. In addition, implementation of avoidance and minimization measures is expected to avoid any negative impacts on five additional endangered species: Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian duck (*Anas wyvilliana*), Hawaiian coot (*Fulica alai*), Hawaiian petrel (*Pterodroma sandwichensis*), Hawaiian Hoary bat (*Lasiurus cinereus semotus*), one threatened species: Newell's shearwater (*Puffinus auricularis newelli*), and one species that is proposed for listing as endangered, 'Āwikiwiki (*Canavalia pubescens*) that are either present at the project site, or could be attracted to the site during or after construction.

The public is encouraged to comment on: The adequacy of the draft HCP to minimize, mitigate, and monitor the proposed incidental take of the Covered Species; adequacy of the funding being provided to implement the proposed mitigation program; adequacy of the adaptive management program; and certainty that mitigation will occur. We are seeking public input on the adequacy of the HCP relative to the license issuance criteria found in HRS §195D-4 and §195D-21. For further information contact: Lasha Salbosa, Conservation Initiatives Coordinator, DLNR DOFAW tel. (808) 587-4148 or Lasha.H.Salbosa@hawaii.gov.

DRAFT

Habitat Conservation Plan for HONUAʻULA (WAILEA 670) KĪHEI, MAUI

PREPARED FOR:

U.S. Fish and Wildlife Service
Hawaiʻi Department of Land and Natural Resources

APPLICANT:

Honuaʻula Partners, LLC
381 Huku Liʻi Place, Suite 202
Kīhei, Maui 96753

PREPARED BY:

SWCA Environmental Consultants
Honolulu Office
Bishop Square: ASB Tower
1001 Bishop Street, Suite 2800
Honolulu, HI. 96813

December 2012

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1.1 Executive Summary

Honuaʻula Partners, LLC proposes to construct a master-planned community encompassing diverse residential opportunities, commercial and retail mixed uses, on-site recreational amenities, integrated bicycle and pedestrian networks, parks, and open space. Honuaʻula will also feature an 18-hole homeowner's golf course and related facilities, as well as a Native Plant Preservation Area and other areas dedicated to the preservation of native plants and archaeological features. As discussed herein, Honuaʻula has undergone significant public review and comment over the past twelve years. Significantly, Honuaʻula has been approved for urban development since 1994 and has received all discretionary land use approvals for residential, limited commercial and golf course uses.

Activities will occur on the proposed Property over the life of the project that may result in the incidental take of Blackburn's sphinx moth (*Manduca blackburni*), a listed endangered species and the loss of Blackburn's sphinx moth habitat. Post-construction activities associated with the proposed 18-hole golf course could attract a second endangered species, nēnē (*Branta sandwichensis*), resulting in the potential for incidental take of this species. These two species are hereafter collectively referred to as the "Covered Species." In addition, implementation of avoidance and minimization measures is expected to avoid any negative impacts on five additional endangered species: Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian duck (*Anas wyvilliana*), Hawaiian coot (*Fulica alai*), Hawaiian petrel (*Pterodroma sandwichensis*), Hawaiian Hoary bat (*Lasiurus cinereus semotus*), one threatened species: Newell's shearwater (*Puffinus auricularis newelli*), and one species that is proposed for listing as endangered, ʻāwikiwiki (*Canavalia pubescens*) that are either present at the project site, or could be attracted to the site during or after construction. Although no impact is anticipated and no take is requested for these species, avoidance and minimization measures for these species are included in this Habitat Conservation Plan (HCP).

This HCP seeks to offset the potential impact of the proposed development on the two Covered Species with measures that protect and provide a net benefit to the species island-wide and statewide. The Applicant anticipates a 13-year build-out phase starting at the end of 2012 or early 2013, throughout which this HCP will be in effect. Construction will occur in three phases, with Phase 1 starting at the onset of grading. The HCP will also cover post-construction maintenance, management, and operations of the development and golf course. Therefore the Applicant seeks a 30-year Incidental Take Permit (ITP) in accordance with Section 10(a)(1)(B) of the federal Endangered Species Act (ESA) of 1973, as amended, and an Incidental Take License (ITL) in accordance with Chapter 195-D of Hawaiʻi Revised Statutes. These permits are issued by the U.S. Fish and Wildlife Service (USFWS) and State Department of Land and Natural Resources (DLNR), respectively. This HCP supports the issuance of these permits, and describes how the Applicant will avoid, minimize, mitigate and monitor the incidental take of threatened and endangered species that may occur during construction and operation of the proposed project. The general and species-specific mitigation measures the Applicant is proposing are intended to increase knowledge of the species' biology and distribution, enhance populations, or restore degraded native habitat (Table 1-1). Mitigation measures are required to provide a net benefit to the species as required under state law.

No substantive scientific information regarding the population biology (e.g. distribution and abundance, density, population genetics) of Blackburn's sphinx moth on Maui exists for use in calculating potential take at Honuaʻula. Therefore, in accordance with the Habitat Conservation Plan Handbook (Chapter 3, Sections B.2.b. and C.1), a habitat-based approach to quantify take was employed to design on-site and off-site mitigation measures.

This HCP, when approved, will fulfill the requirements for an Incidental Take Permit (ITP) in accordance with Section 10(a)(1)(B) of the federal Endangered Species Act (ESA) of 1973, as amended, and an Incidental Take License (ITL) in accordance with Chapter 195-D of Hawaiʻi Revised Statutes.

Table 1-1: Mitigation Summary. These mitigation measures will be provided in addition to general avoidance, minimization, and mitigation measures, and comprise the principal mitigation measures that will be implemented to offset the requested take of two Covered Species.

Blackburn's sphinx moth
A. Native Plant Preservation Area
1. Perpetual onsite conservation easement on 40 acres. **2.** Weed control including manual, chemical, mechanical removal. Tree tobacco will not be removed, unless required by USFWS and DOFAW. **3.** Control of rats. **4.** Enhancement and maintenance of native plant community through propagation and outplanting. **5.** The area will be enclosed by stone wall. Ungulates will be excluded from the entire Property. **6.** Plan includes interpretive trails and informational signs. **7.** The area is designed to conserve native vegetation and BSM habitat, and will also provide protection to cultural sites present on site. Trails will allow access for cultural practitioners.
B. Kanaio Conservation Easement
1. The conveyance of a perpetual easement has been approved by the land owner. The easement will be developed and established, through the coordination with DOFAW, the landowner, and Honuaʻula Partners LLC prior to initiation of Phase 1 construction. **2.** An 8 foot ungulate fence currently exists along the northeastern border of the mitigation parcel. This fence will be extended along the remaining borders of the site. The fence will be maintained in perpetuity using a fund established through sales of Honuaʻula properties. **3.** Ungulates will be removed from the enclosure using professional removal techniques. Combined with the fencing, this action will remove one of the primary threats to the existing Blackburn's sphinx moth habitat at the mitigation site. Ungulate removal will be completed within two years, after which the area will be monitored quarterly for ungulate presence and kept clear of ungulates. **4.** A 10-foot wide green fire break will be established within two years of Phase 1 groundbreaking and it will be maintained along the perimeter of the fence to prevent fires started outside the parcel from entering the mitigation area. This fire break, which will act as a green break, will be maintained at no less than 50% cover of kikuyu grass (*Cenchrus clandestinus*), at a height of no more than 6 inches. This fire break will be established over the course of two years and will be maintained in perpetuity. If any portion of the mitigation site is impacted by fire, restoration will be initiated within six months. If any portion of the mitigation site is burned at any time after initiation of Phase I construction at the Property, intensive restoration will be initiated in the burned area within one month. **5.** A cross fencing plan for adjacent land is being developed in coordination with the landowner, Ulupalakua Ranch. Cross fencing will be designed to facilitate rotating cattle grazing in such a pattern to enhance fire control on grazing lands immediately adjacent to the protected area. Fuel management in the areas below (south) of the restoration site will be adequate to ensure a fire igniting at the road below the site will not spread to the mitigation site's location. **6.** The cover of non-native species will be reduced, within five years of initiation of Phase I construction, to less than 25% cover. Thereafter, cover of non-native species will be maintained at less than 25% in perpetuity. Cover of native tree, shrub, vine, and herb species that were elements of the original forest community will be restored, where necessary within 15 years of initiation of Phase 1 construction and a native dry forest ecosystem will be maintained on the site in perpetuity. **7.** ʻĀwikiwiki is suitable for restoration only at the lower elevation Kanaio mitigation site. The species is a short-lived perennial vine that is easy to propagate but difficult to outplant. Re-establishment of ʻāwikiwiki at the Kanaio mitigation area will be conducted by seed scattering and experimentation with outplanting technologies. Between years 10-15, an annual average of 50 ʻāwikiwiki plants will be present at the Kanaio

mitigation area, with an annual range between 0 to 500 plants. This population will no longer require outplantings to maintain stable and increasing cover trend, and will be maintained in perpetuity.
C. Auwahi Conservation Easement
1. The conveyance of a perpetual easement has been approved by the land owner. The easement will be developed and established, through the coordination with DOFAW, the landowner, and Honuaʻula Partners LLC prior to initiation of Phase 1 construction. **2.** An 8 foot fence already exists surrounding the entire 190 acre Auwahi Forest Restoration Project, but ungulate grazing continues in most of the area within the enclosure. As restoration of the site progresses fences will be moved or installed and ungulates will be removed from and kept clear of restoration areas. **3.** A 10-foot wide fire break will be established along the perimeter of the fence to prevent fires started outside the parcel from entering the mitigation area. This fire break, which will act as a green break, will be maintained at no less than 50% cover of kikuyu grass (*Cenchrus clandestinus*), at a height of no more than 6 inches This fire break will be established over the course of two years and will be maintained in perpetuity. If any portion of the mitigation site is impacted by fire, restoration will be initiated within six months. If any portion of the mitigation site is burned at any time after initiation of Phase I development at the Property, intensive restoration will be initiated in the burned area within one month. **4.** This area is included in the cross fencing plan described in item e in section 7.4.1.1. As it relates to protection of the approximately 190 acre Auwahi Forest Restoration Project, fuel management in the areas below (south) of the restoration site will be adequate to ensure a fire igniting at the road below the site will not spread to the mitigation site's location. **5.** Kikuyu grass will be removed using a combination of mechanical and chemical removal techniques. The cover of non-native species will be reduced, within five years of initiation of Phase I construction, to less than 5% cover. Thereafter, cover of non-native species will be maintained at less than 5% in perpetuity. **6.** Native tree, shrub, vine, and herb species that were elements of the original forest community will be replanted and maintained. A minimum of 500 aiea plants will be propagated and outplanted to the Kanaio/Auwahi mitigation sites within 10 years of initiation of Phase I construction. In year 15 of the permit and beyond, a minimum of 550 aiea will be maintained within the mitigation site.
D. Endowment
1. Maintenance of the three mitigation areas will be maintained in perpetuity through the establishment of an endowment. The endowment will be managed by a conservation organization, entity, or management board that will be selected prior to issuance of the Permit. Habitat within the conservation easements will be managed under the supervision of Honu'aula Partners LLC during the first 15 years of the Permit term. Thereafter, habitat management will be implemented under the supervision of a conservation organization to be agreed upon and named prior to Permit issuance. The endowment funding mitigation for the impacts of Phase 1 construction will be more than 50% funded prior to initiation of Phase 1 construction, and further funding assurances are provided in the form of a property-wide annual assessment, secured by a covenant. Likewise, endowment funding for Phase 2 and 3 construction will be put into place prior to initiation of construction for Phase 2 and 3.
Nēnē
A. Alternative 1
An annual contribution of $5000 will be made for the operating cost of the Hawaii Wildlife Center for five years, in addition to payment of $3000 per bird for the rehabilitation and release of five nēnē.
A. Alternative 2

Alternatively the proposed mitigation measures may consist of providing funding of $30,000 to DLNR for the propagation and release of a total of eight goslings over a three year period.

1.2 Applicant

The Property was acquired in 2000 by California-based WCPT/GW Land Associates, LCC, which was later succeeded by Honuaʻula Partners, LLC, a successor-in-interest to WCPT/GW Land Associates, and the current owner of the Property. When acquired the subject property was designated for development as Project District 9 in the Kīhei/Mākena Community Plan, zoned for two 18-hole golf courses and limited support uses, and designated Urban by the State Land Use Commission. The applicant's intention from the beginning of this process has been to develop the property consistent with the provisions provided for within the Kīhei/Mākena Community Plan. The applicant initiated a Change in Zoning (CIZ) application with the County of Maui in the fall of 2000, received a recommendation for approval and transmittal to the Maui County Council (Council) from the Maui Planning Commission (MPC) in October of 2001. The applicant initiated hearings with the Council in January of 2002, received a recommendation for approval with conditions from the Council Land Use Committee in November of 2007 and final Project District zoning approval from the Council in March of 2008. Then Mayor Charmaine Tavares signed the legislation into law on April 8, 2008.

Subsequent to final zoning approval the applicant has initiated compliance with the conditions of approval consistent with the provisions of Project District Zoning Ordinance 19.90A. These actions include initiation of an Environmental Impact Statement (EIS) and Phase II zoning application. The Accepting authority for the EIS is the MPC and Phase II zoning approval will be issued by the MPC. Both of these submittals are presently in process with the MPC.

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1.3 Regulatory Context

1.3.1 Federal Endangered Species Act (16 U.S.C. 1531-1544)

Section 9 of the Endangered Species Act (ESA) prohibits the unauthorized "take" of any endangered or threatened species of fish or wildlife listed under the ESA. Under the ESA, the term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect species listed as endangered or threatened, or to attempt to engage in any such conduct. "Harm" in the definition of "take" in the ESA means an act which actually kills or injures wildlife, and may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering (50 CFR 17.3). "Harass" in the definition of take in the ESA means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering (50 CFR 17.3).

The U.S. Fish and Wildlife Service (USFWS) may permit, under certain terms and conditions, any taking otherwise prohibited by Section 9 of the ESA if such taking is incidental to the carrying out of an otherwise lawful activity. To apply for an ITP, an applicant must develop, fund and implement a USFWS-approved HCP to minimize and mitigate the effects of the incidental take. Such take may be permitted provided the following issuance criteria of ESA Section 10(a)(1)(B) and 50 CFR §17.22(b)(2) and 50 CFR §17.32(b)(2) are met:

- The taking will be incidental;
- The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such takings;
- The applicant will ensure that adequate funding for the conservation plan and procedures to deal with unforeseen circumstances will be provided;
- The taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild; and

- Other necessary or appropriate measures required by the Secretary of the Interior, if any, will be met.

To obtain an ITP, an applicant must prepare a supporting HCP that provides the following information described in ESA Section 10(a)(2)(A) and 50 CFR 17.22(b)(1) and 50 CFR §17.32(b)(1):

- The impact that will likely result from such taking;
- The measures the applicant will undertake to monitor, minimize and mitigate such impacts, the funding that will be available to implement such measures, and the procedures to be used to deal with unforeseen circumstances;
- The alternative actions to such taking the applicant considered and the reasons why such alternatives are not proposed to be utilized; and
- Such other measures that the Director of the USFWS may require as necessary or appropriate for purposes of the plan.

The *Habitat Conservation Planning and Incidental Take Permit Processing Handbook*, published by the USFWS and the National Marine Fisheries Service (NMFS) in November 1996, provides additional policy guidance concerning the preparation and content of HCPs. The USFWS and NMFS published an addendum to the *HCP Handbook* on June 1, 2000 (65 FR 35242) (USFWS and NOAA 2000). This addendum, also known as the Five-Point Policy, provides clarifying guidance for the two agencies in issuing ITPs and for those applying for an ITP under Section 10. The five components addressed in the policy are discussed briefly below:

Biological Goals and Objectives: HCPs must include biological goals (broad guiding principles for the conservation program – the rationale behind the minimization and mitigation strategies), and biological objectives (the measurable targets for achieving the biological goals). These goals and objectives must be based on the best scientific information available and are used to guide conservation strategies for species covered by the plan.

Adaptive Management: The Five-Point Policy encourages the development of adaptive management plans as part of the HCP process under certain circumstances. Adaptive management is an integrated method for addressing biological uncertainty and devising alternative strategies for meeting biological goals and objectives. An adaptive management strategy is essential for HCPs that would otherwise pose a significant risk to the Covered Species due to significant information gaps.

Monitoring: According to the Fife-Point policy, monitoring is a mandatory element of all HCPs. As such, an HCP must provide for monitoring programs to gauge the effectiveness of the plan in meeting the biological goals and objectives, and to verify that the terms and conditions of the plan are being properly implemented.

Permit Duration: Under existing regulations, several factors are used to determine the duration of an ITP, including the duration of the applicant's proposed activities and the expected positive and negative effects on Covered Species associated with the proposed duration. Under the Five-Point Policy, the USFWS will also consider the level of scientific and commercial data underlying the proposed operating conservation program, the length of time necessary to implement and achieve the benefits of the operating conservation program, and the extent to which the program incorporates adaptive management strategies.

Public Participation: Under the Five-Point Policy guidance, the USFWS announced its intent to expand public participation in the HCP process to provide greater opportunity for the public to assess, review and analyze HCPs and associated documentation (e.g., National Environmental Policy Act [NEPA] review). As part of this effort, the USFWS has expanded the public review process for most HCPs from a 30-day comment period to a 60-day period.

1.3.2 Federal National Environmental Policy Act (42 U.S.C. 4371 et seq.)

Issuance of an ITP is a federal action subject to compliance with the National Environmental Policy Act (NEPA). The purpose of NEPA is to promote agency analysis and public disclosure of the environmental issues surrounding a proposed federal action to reach a decision that reflects NEPA's mandate to strive for balance between human activity and the natural world. The scope of NEPA goes beyond that of the ESA by considering the impact of a federal action on non-wildlife resources, such as water quality, air quality and cultural resources. The USFWS will prepare and provide for public review an Environmental Assessment (EA) to evaluate the potential environmental impacts of issuing an ITP and approving the implementation of the proposed Honuaʻula HCP. The purpose of the EA is to determine if ITP issuance and HCP implementation will significantly affect the quality of the human environment. If the USFWS determines significant impacts are likely to occur, a comprehensive Environmental Impact Statement (EIS) for the proposed action will be prepared and distributed for public review; otherwise, a Finding of No Significant Impact (FONSI) will be issued. The USFWS will not make a decision on ITP issuance until after the NEPA process is complete.

1.3.3 Federal Migratory Bird Treaty Act (16 U.S.C. 703-712)

The nēnē, as well as the four waterbird species addressed in this HCP, are also protected under the Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 USC 703-712). The MBTA prohibits the take of migratory birds. A list of birds protected under MBTA implementing regulations is provided at 50 CFR §10.13. Unless permitted by regulations, under the MBTA it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product.

The MBTA provides no process for authorizing incidental take of MBTA-protected birds. However, if the HCP is approved and USFWS issues an ITP to the Applicant, the terms and conditions of that ITP will also constitute a Special Purpose Permit under 50 CFR §21.27 for the take of the nēnē under the MBTA. Therefore, subject to the terms and conditions to be specified in the ITP, if issued, any such take of nēnē also will not be in violation of the MBTA. However, because the MBTA provides for no incidental take authorization, other MBTA-protected birds that are not protected by the ESA and that may be adversely affected by the proposed project will not be covered by any take authorization.

1.3.4 Federal National Historic Preservation Act (16 U.S.C. 470-470b, 470c-470n)

USFWS issuance of an ITP under ESA Section 10(a)(1)(B) is considered an "undertaking" covered by the Advisory Council on Historic Preservation and must comply with Section 106 of the National Historic Preservation Act (NHPA) (36 CFR §800). The undertaking is defined as the land-use activity that may proceed once an ITP is issued to an Applicant. Section 106 requires USFWS to assess and determine the potential effects on historic properties that would result from the proposed undertaking and to develop measures to avoid or mitigate any adverse effects. Accordingly, USFWS must consult with the Advisory Council on Historic Preservation, the State Historic Preservation Officer (SHPO), affected Tribes, the applicant, and other interested parties, and make a good-faith effort to consider and incorporate their comments into project planning.

The USFWS will determine the "area of potential effects" associated with the proposed undertaking, which is usually defined as the geographic area where the undertaking may directly or indirectly change the character or use of historic properties included in or eligible for inclusion in the National Register of Historic Places. The USFWS generally interprets the area of potential effects as the specific location where incidental take may occur and where ground-disturbing activities may affect historic properties. The USFWS, in consultation with the SHPO, must make a reasonable and good-faith effort to identify undiscovered historic properties. The USFWS also determines the extent of any archeological investigations that may be required; the cost of NHPA compliance, however, rests with the Applicant.

Extensive archaeological and cultural resources surveys and impact studies have been conducted for the project, and Honuaʻula Partners, LLC has consulted with SHPO/SHPD. A cultural preservation plan has been created for the Property, and a final AIS has been submitted for approval by SHPD.

1.3.5 Hawai'i Revised Statutes, Chapter 195D

Section 195D-4, Hawaiʻi Revised Statutes (HRS), states that any endangered or threatened species of fish or wildlife recognized by the ESA shall be so deemed by State statute. Like the ESA, the unauthorized "take" of such endangered or threatened species is prohibited [§195D-4(e)]. The definition of "take" in Section 195D-2, HRS, mirrors the ESA definition.

Under §195D-4(g), the Board of Land and Natural Resources (BLNR), after consultation with the State's Endangered Species Recovery Committee (ESRC), may issue a temporary license (subsequently referred to as an "ITL") to allow a take otherwise prohibited if the take is incidental to the carrying out of an otherwise lawful activity. To qualify for an ITL, the following conditions must be met:

- The applicant minimizes and mitigates the impacts of the take to the maximum extent practicable (i.e., implements an HCP);
- The applicant guarantees that adequate funding for the HCP will be provided;
- The applicant posts a bond, provides an irrevocable letter of credit, insurance, or surety bond, or provides other similar financial tools, including depositing a sum of money in the endangered species trust fund created by §195D-31, or provides other means approved by BLNR, adequate to ensure monitoring of the species by the State and to ensure that the applicant takes all actions necessary to minimize and mitigate the impacts of the take;
- The plan increases the likelihood that the species will survive and recover;
- The plan takes into consideration the full range of the species on the island so that cumulative impacts associated with the take can be adequately assessed;
- The activity permitted and facilitated by the license to take a species does not involve the use of submerged lands, mining or blasting;
- The cumulative impact of the activity, which is permitted and facilitated by the license, provides net environmental benefits; and
- The take is not likely to cause the loss of genetic representation of an affected population of any endangered, threatened, proposed or candidate plant species.

Section 195D-4(i) directs the Department of Land and Natural Resources (DLNR) to work cooperatively with federal agencies in concurrently processing HCPs, ITLs and ITPs. Section 195D-21 deals specifically with HCPs and its provisions are similar to those in federal regulations. HCPs submitted in support of an ITL application must:

- Identify the geographic area encompassed by the plan; the ecosystems, natural communities, or habitat types within the plan area that are the focus of the plan; and the endangered, threatened, proposed and candidate species known or reasonably expected to be present in those ecosystems, natural communities or habitat types in the plan area;
- Describe the activities contemplated to be undertaken within the plan area with sufficient detail to allow DLNR to evaluate the impact of the activities on the particular ecosystems, natural communities or habitat types within the plan area that are the focus of the plan;
- Identify the steps that will be taken to minimize and mitigate all negative impacts, including without limitation the impact of any authorized incidental take, with consideration of the full range of the species on the island so that cumulative impacts associated with the take can be adequately assessed; and the funding that will be available to implement those steps;
- Identify the measures or actions to be undertaken; a schedule for implementation of the measures or actions; and an adequate funding source to ensure that the actions or measures are undertaken in accordance with the schedule;
- Be consistent with the goals and objectives of any approved recovery plan for any endangered species or threatened species known or reasonably expected to occur in the ecosystems, natural communities or habitat types in the plan area;

- Provide reasonable certainty that the ecosystems, natural communities or habitat types will be maintained in the plan area throughout the life of the plan;
- Contain objective, measurable goals; time frames within which the goals are to be achieved; provisions for monitoring; and provisions for evaluating progress in achieving the goals quantitatively and qualitatively; and
- Provide for an adaptive management strategy that specifies the actions to be taken periodically if the plan is not achieving its goals.

Section 195D-25 provides for the creation of the ESRC, which is composed of biological experts, representatives of relevant federal and state agencies (i.e., USFWS, U.S. Geological Survey [USGS], DLNR), and appropriate governmental and non-governmental members to serve as a consultant to the DLNR and the BLNR on matters relating to endangered, threatened, proposed and candidate species.

Duties of the ESRC include reviewing all applications for HCPs, Safe Harbor Agreements, and ITLs, and making recommendations to the DLNR and the BLNR on whether they should be approved, amended or rejected; reviewing all existing HCPs, Safe Harbor Agreements and ITLs annually to ensure compliance, and making recommendations for any necessary changes; and considering and recommending appropriate incentives to encourage landowners to voluntarily engage in efforts that restore and conserve endangered, threatened, proposed, and candidate species. Hence, the ESRC plays a significant role in the HCP planning process. The Applicant provided a pre-HCP introductory presentation to the ESRC on December 6th, 2010.

1.3.6 Hawaiʻi Revised Statutes, Chapter 343

Chapter 343, Hawaiʻi Revised Statutes (Environmental Impact Statements) was developed to establish a system of environmental review which will ensure that environmental concerns are given appropriate consideration in decision making along with economic and technical considerations (§343-1, HRS).

A State Environmental Impact Statement (EIS) was prepared for Honuaʻula (PBR Hawaiʻi 2010, 2012), because the project involves:

- Extension of Piʻilani Highway from Wailea Ike Drive to Kaukahi Street, a portion of which will be on right-of-way (ROW) owned by the State of Hawaiʻi, and;
- Possible development of an on-site wastewater treatment facility.

The Maui County Planning Department submitted the EISPN to the State of Hawaiʻi Office of Environmental Quality Control (OEQC) on February 23, 2009. Notice of the availability of the EISPN was published in the March 8, 2009 edition of the OEQC's *The Environmental Notice*. The public comment period for the EISPN began March 8, 2009 and ended April, 7, 2009.

The Maui County Planning Department subsequently submitted an EA/EISPN to OEQC on September 18, 2009. Notice of the availability of the EA/EISPN was published in the October 8, 2009 edition of the OEQC's *The Environmental Notice*. The official public comment period on the EA/EISPN was from October 8, 2009 to November 7, 2009; however, Honuaʻula Partners, LLC voluntarily extended the comment period until November 17, 2009 to allow all consulted parties ample time to provide comments.

Subsequent to the EA/EISPN public comment period, Maui County Planning Department submitted the Draft EIS to OEQC on April 13, 2010. Notice of the availability of the Draft EIS was published in the April 23, 2010 edition of OEQC's *The Environmental Notice*. The official 45-day public comment period on the Draft EIS was from April 23, 2010 to June 7, 2010; however as a courtesy to those that requested more time to review the Draft EIS, Honuaʻula Partners, LLC again voluntarily extended the comment period on the Draft EIS until June 30, 2010. The Maui County Planning Department approved the FEIS on July 24, 2012 (PBR Hawaiʻi 2012).

1.4 Project Description

1.4.1 Project History

The first Environmental Impact Statement (EIS) approved for development of this site was published by PBR Hawaiʻi in 1988. In 1992, the Community Plan Amendment and FEIS were approved as Project District 9 in the Kīhei-Mākena Community Plan and Chapter 19.90A, Maui County Code ("MCC"). In 1993, Project district zoning approval was received for the entire 670 acre Property. In 1994, the State Land Use Commission issued its Decision and Order approving Urban Designation for the Property. Following project redesign, the Maui County Council approved Bills 21 and 22 in December 2007 providing for Conditional Project district zoning for all 670 acres allowing for residential, limited commercial, golf course and open space zoning.

1.4.2 Project Design and Components

Honuaʻula will be a master-planned community encompassing diverse residential opportunities, commercial and retail mixed uses, on-site recreational amenities, integrated bicycle and pedestrian networks, parks, and open space. Honuaʻula will also feature an 18-hole homeowner's golf course and related facilities, as well as a Native Plant Preservation Area and other areas dedicated to the preservation of native plants and archaeological features. As discussed herein, Honuaʻula has been planned and undergone significant public review and comment for over twelve years. More significantly, Honuaʻula has been approved for urban development since 1994 and has received all discretionary land use approvals for residential, limited commercial and golf course uses.

Honuaʻula will provide homes priced for a range of consumer groups, including workforce affordable homes in compliance with Chapter 2.96, MCC (Residential Workforce Housing Policy). It will reflect community values and feature distinctive architecture to create a unique and compelling community in context with the Kīhei-Mākena region. This cohesive approach will integrate natural and human-made boundaries and landmarks to craft a sense of place within a defined community. In addition, a principal design and planning goal is to preserve defining features of Honuaʻula, such as the topography and views, as much as possible.

1.4.3 Covered Activities

This HCP, and associated Federal and State incidental take authorizations to be issued by the USFWS and DLNR will cover and provide authorization for incidental take resulting from the following activities, which will occur as part of the project. These are subject to any requirements or restrictions described in this HCP or the incidental take authorization documents:

- Grading and earth-moving
- Installation and construction of infrastructure
- Construction of homes and facilities
- Installation of landscaping
- Driving and biking on the Property by employees, contractors, and public on established roadways, sidewalks, and paths in accordance with posted speed limits
- Operation, maintenance, and management of all constructed facilities
- Operation, maintenance, and management of the golf course
- General property operation, management of maintenance facilities, including landscape maintenance
- Implementation of the conservation measures outlined in this HCP

Figure 1.1: Project Location

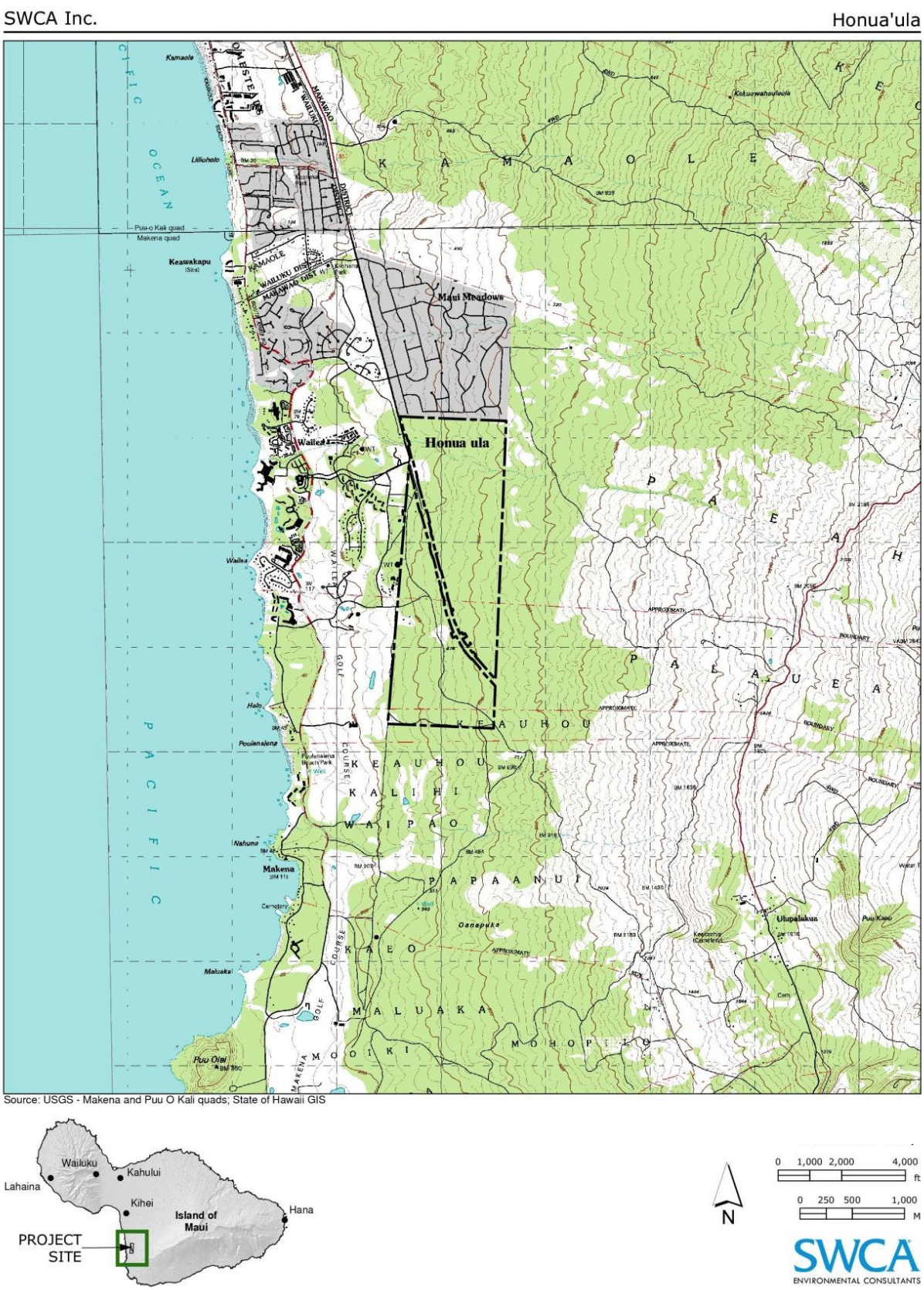


Figure 1.2: Conceptual Project Layout

1.4.4 Purpose and Need for Honuaʻula Project

The purpose and intent of Honuaʻula is to implement the Project District 9 ordinance (Chapter 19.90A, MCC) governing the Property, which establishes permissible land uses and appropriate standards of development for a residential community consisting of single-family and multi-family dwellings complemented with village mixed uses, all integrated with an 18-hole homeowner's golf course and other recreational amenities. As planned, Honuaʻula is consistent with the residential, commercial, and recreational uses in the Kīhei-Mākena Community Plan, which has been affirmed through a community-based process. Consistent with the Kīhei-Mākena Community Plan and Chapter 19.90A, MCC, Honuaʻula will:

- Provide a mix of single- and multi-family housing types for a range of consumer groups;
- Emphasize community development with single- and multi-family units complemented with village mixed uses and commercial uses primarily serving the residents of the community;
- Integrate a golf course and other recreational amenities with the different uses within Honuaʻula;
- Integrate community-oriented parks with pedestrian and bicycle recreation ways;
- Incorporate buffer zones between residential areas and the Piʻilani Highway extension corridor; and
- Provide a site for future public use in anticipation of need (PBR Hawaiʻi 2010).

The need for Honuaʻula stems from a substantial unmet demand for housing, including workforce housing, in the Kīhei-Mākena region over the coming two decades. It is projected that demand for new residential units in the Kīhei-Mākena region will range from 7,000 to over 10,000 units over the next 22 years. Excluding Honuaʻula, a total of approximately 5,160 units are either currently unsold or planned in the region, resulting in a projected regional shortfall of 1,840 to 5,686 units. Therefore, Honuaʻula, with its housing units priced for a range of consumer groups, will serve to satisfy the unmet demand for housing in the Kīhei-Mākena region (Hallstrom 2009).

Honuaʻula is also needed for the significant economic benefits it will provide. Honuaʻula is expected to infuse more than one billion dollars in capital investment into the Maui economy and create thousands of jobs during the projected 13-year construction and build-out period. After construction, Honuaʻula will provide hundreds of permanent jobs and contribute over one and a half million dollars in annual property tax revenue to the County of Maui. Positive economic contributions by the creation of Honua'ula will include approximately:

- $1.2 billion of direct capital investment in the Maui economy during the build-out period;
- 9,537 "worker years" of direct on-site employment during the build-out period;
- $480 million in employee wages paid out during the build-out period;
- 518 jobs (382 directly related to on-site activities and 136 related to indirect off-site activities) after the build-out period;
- $19 million in annual wages from the on and off-site jobs after the build-out period;
- $513.9 million (nearly $40 million annually) in discretionary expenditures into the Maui economy by Honuaʻula residents and guests during the build-out period;
- $77 million annually in discretionary expenditures into the Maui economy by Honuaʻula residents and guests after the build-out period;
- $41.8 million in net tax revenue benefit (taxes less costs) to the County of Maui during the build-out period;
- $1.6 million in annual net tax revenue benefit (taxes less costs) to the County of Maui after the build-out period;
- $97 million in net tax revenue benefit (taxes less costs) to the State of Hawaiʻi during the build-out period; and
- $1.5 million in annual net tax revenue benefit (taxes less costs) to the State of Hawaiʻi after the build-out period.

Furthermore, if developed, Honuaʻula will contribute significantly to the provision of public services by providing $5 million to the County for the development of the South Maui Community Park, $3.45 million to the Department of Education, two acres of land to the creation of a fire station, and $550,000 to the County for the development of a police station.

1.5 List of Preparers

Jason Balmut, B.A., Senior GIS Analyst, SWCA Environmental Consultants
Jaap Eijzenga, M.S., Wildlife Ecologist, SWCA Environmental Consultants
James Feldman, M.S. AICP, Environmental Planner, SWCA Environmental Consultants
John Ford, M.S., Pacific Office Principal, SWCA Environmental Consultants
Ling Ong, Ph.D., Fish and Wildlife Biologist, SWCA Environmental Consultants
Teifion Rice-Evans, M.A., Managing Principal, Economic & Planning Systems (EPS).

2 DESCRIPTION OF HABITAT CONSERVATION PLAN

2.1 Purpose of This HCP

Activities will occur on the proposed Property over the life of the project that may result in the incidental take of Blackburn's sphinx moth (*Manduca blackburni*) and the loss of Blackburn's sphinx moth habitat. Post-construction activities associated with the proposed 18-hole golf course could attract a second endangered species, nēnē (*Branta sandwichensis*) resulting in potential for incidental take of this species. In addition, implementation of avoidance and minimization measures is expected to avoid any negative impacts on five additional endangered species: Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian duck (*Anas wyvilliana*), Hawaiian coot (*Fulica alai*), Hawaiian petrel (*Pterodroma sandwichensis*), Hawaiian Hoary bat (*Lasiurus cinereus semotus*), one threatened species: Newell's shearwater (*Puffinus auricularis newelli*), and one species currently proposed for listing as endangered, ʻāwikiwiki (*Canavalia pubescens*) that are either present at the project site, or could be attracted to the site during or after construction. Although no impact is anticipated and no take is requested for these species, avoidance and minimization measures for these species are included in this HCP.

These species are protected under the ESA, as amended. Because of the documented presence of these species at or near the proposed facility and the anticipated take in connection with construction and operation of the proposed project, the Applicant has filed an application for an ITP in accordance with Section 10(a)(1)(B) of the ESA and an ITL pursuant to HRS Chapter 195-D. This HCP has been prepared to fulfill application requirements for these permits. Upon issuance of the ITL, the Applicant will be authorized for the clearing of Blackburn's sphinx moth habitat in connection with the otherwise lawful construction and operation of the proposed project.

The purpose of this HCP is to address the following:

1. To make the most supportable determinations as to the potential impact that the development could have on the listed species;
2. To discuss alternatives to the proposed development and its design, in terms of these impacts;
3. To propose appropriate efforts to minimize, mitigate, and monitor these potential impacts to the maximum extent practicable;
4. To ensure funding for the completion of these efforts; and
5. To provide for adaptive management and adjustment of the above measures as determined during implementation of the HCP.

2.2 Scope and Term

This HCP seeks to offset the potential impact of the proposed development on the Covered Species with measures that protect and provide a net benefit to the species island wide and statewide. The Applicant anticipates a 13-year build-out starting at the end of 2012, or early 2013 throughout which this HCP will be in effect. The HCP will also cover post-construction maintenance, management, and operations of the development and golf course. Therefore, the Applicant seeks a 30-year ITP and ITL. The ITP and ITL will be issued to take effect at the initiation of Phase I construction, during and after which anticipated impacts are expected.

No substantive scientific information regarding the population biology (e.g. distribution and abundance, density, population genetics) of Blackburn's sphinx moth on Maui exists for use in calculating potential take at Honuaʻula. Therefore, in accordance with the Habitat Conservation Plan Handbook (Chapter 3, Sections B.2.b. and C.1), a habitat-based approach to quantify take will be employed to design on-site and off-site mitigation measures.

2.3 Surveys and Resources

The following sources were utilized in the preparation of this HCP. Many of these documents cite additional relevant studies:

- EIS and appendices for Wailea 670 (PBR Hawaiʻi 1988)
- DEIS and appendices for Honuaʻula (PBR Hawaiʻi 2010)
- FEIS and appendices for Honuaʻula (PBR Hawaiʻi 2012)
- Ground Water Resources Assessments
- Marine Water Quality Assessment
- Marine Environmental Assessments
- Golf Course Best Management Practices
- Botanical Surveys of Honuaʻula (SWCA 2009a)
- Botanical Survey of Alternate Sewer Line Alignments to the Mākena WWTF (SWCA 2009c)
- Botanical Survey of Alternate Water Line Alignments to Honuaʻula (SWCA 2010b)
- Wildlife Surveys of Honuaʻula (referenced in SWCA 2009b);
- Wildlife Survey of Alternate Sewer Line Alignments to the Mākena WWTF (SWCA 2009d)
- Wildlife Survey of Alternate Water Line Alignments to Honuaʻula (SWCA 2010b)
- Conservation & Stewardship Plan and Animal Management Plan for Honuaʻula (SWCA 2010a)
- Archaeological Inventory Surveys
- Cultural Impact Assessments
- Cultural Resources Preservation Plan
- Archaeological Preservation and Mitigation Plan

Table 2-1: Federal and/or State listed species addressed within this HCP.

Scientific Name	Common, Hawaiian Name(s)	Date Listed	Status[1]
Take Requested			
Manduca blackburni	Blackburn's sphinx moth	02/01/2000	E
Branta sandwichensis	Hawaiian goose, nēnē	03/11/1967	E
No Take Requested			
Pterodroma sandwichensis	Hawaiian petrel	03/11/1967	E
Puffinus auricularis newelli	Newell's shearwater, ʻaʻo	10/28/1975	T
Anas wyvilliana	Hawaiian duck, koloa maoli	03/11/1967	E
Himantopus mexicanus knudseni	Hawaiian stilt, aeʻo	10/13/1970	E
Fulica americana alai	Hawaiian coot, ʻala keʻokeʻo	10/13/1970	E
Asio flammeus sandwichensis[2]	Hawaiian short-eared owl, pueo	--	--
Lasiurus cinereus semotus	Hawaiian hoary bat, ʻopeʻapeʻa	10/13/1970	E
Canavalia pubescens	ʻāwikiwiki	--	P[3]

[1)] E = Federally endangered; T = Federally threatened; P = Proposed for listing (Federal)

[2] The Hawaiian short-eared owl is not a federally listed as an endangered species. Only Oʻahu Island populations of the short-eared owl are listed as endangered by the State of Hawaiʻi.

[3] *Canavalia pubescence* was proposed for listing as endangered on June 11, 2012.

3 ENVIRONMENTAL SETTING

3.1 Location, Vicinity, & Climate

Honuaʻula encompasses a rectangular area of 270 ha (670 ac) on the southeastern slope of Mt. Haleakalā, Paeahu Ahupuaʻa, Maui, between 295-804 feet (90-245 m) elevation (Figure 1.1). Local climatic conditions at the site are characteristic for the dry, sunny, and warm, leeward Kīhei-Mākena coast. Average monthly temperatures in the region range from 71.7°F (January) to 78.5°F (August) (Western Regional Climate Center 2005). The area is arid, with mean annual precipitation ranging from 406 to 508 mm (16 to 20 inches) throughout the region (Maui County Data Book 2008). Northeast trade winds prevail approximately 80 to 85 percent of the time averaging 10 to 15 miles per hour (mph) during the afternoons, with slightly lighter winds in the mornings and nights. Southerly Kona winds occur most commonly between October and April (Maui County Databook 2008).

3.2 Topography and Geology

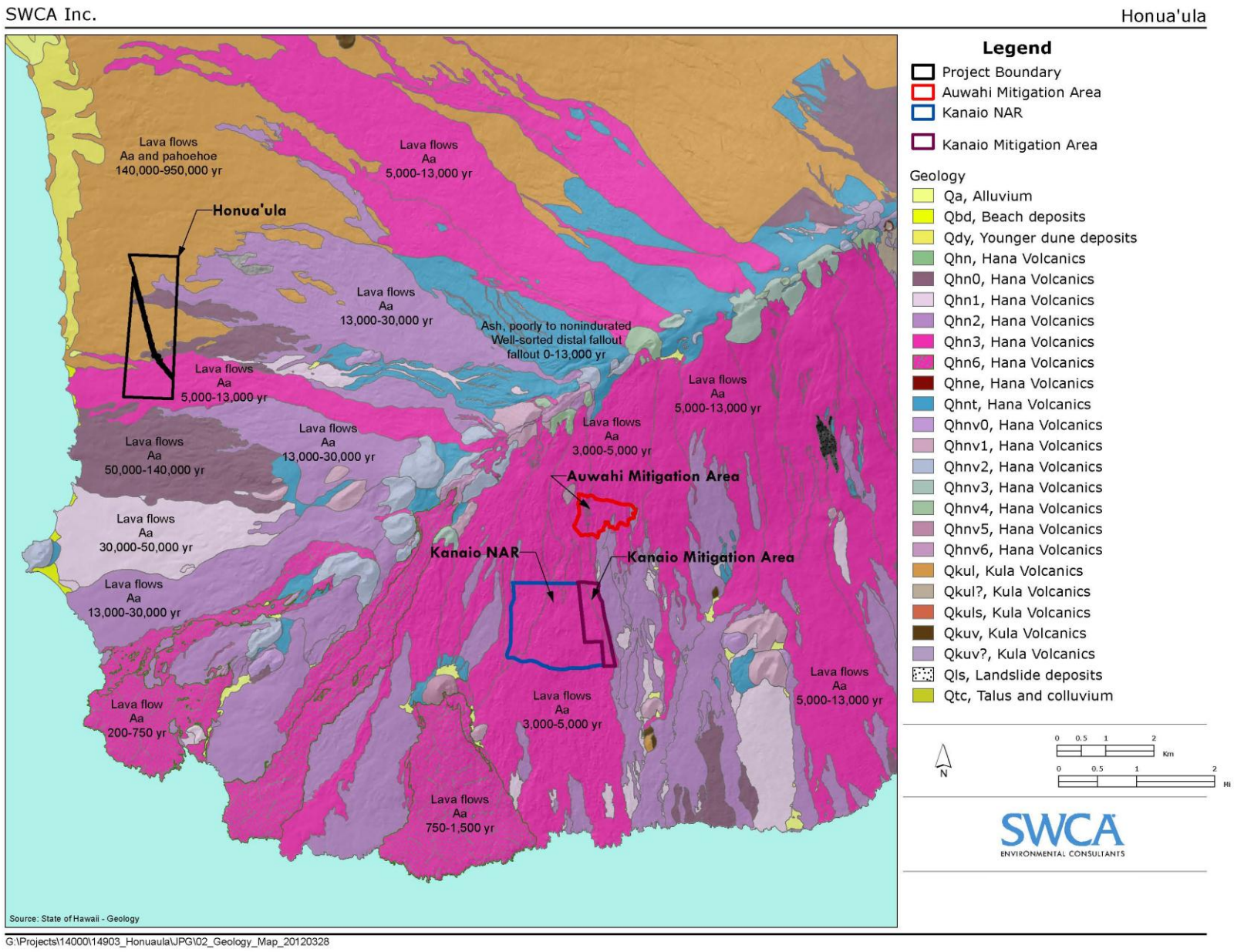
Approximately 200 ha (495 ac) of land in the northern three-quarters of the Honuaʻula Property is underlain by older lava flows of the Kula Volcanic Series (ranging from 13,000 to 950,000 years old). Weathering of lavas led to the formation of a thin layer of soil over the northern portion. About 70 ha (170 ac) of younger lava of the Hana Volcanic Series (between 5,000 and 13,000 years old) makes up the southern quarter of the Property. The southern lava flows have not undergone extensive weathering. This southern area is characterized by an extremely rough surface composed of broken ʻaʻā lava blocks called clinker with little or no soil accumulation (PBR Hawaiʻi 1988). The soils and lavas covering the Property, and the drainage gulches that run across the land, strongly influence the nature of the vegetation that grows there. Altenberg (2010) describes it as follows: "ʻAʻā habitat consists of microsites of soil scattered among clinker lava".

3.3 Soils

The USDA-SCS Natural Resources Conservation Service, Soil Survey of the Islands of Kauaʻi, Oʻahu, Maui, Molokaʻi, and Lanaiʻi classifies the soils at the Property area into four soil types of two soil associations: Keawakapu-Mākena association and Kamaʻole-Oanapuka association. The USDA-SCS designates the four on-site soil types as: 1) Oanapuka, very stony loam (OAD); 2) Very Stony Land (rVS); 3) Mākena Loam, stony complex (MXC); and 4) Keawakapu, extremely stony silty clay loam (KNXD). Mākena Loam, stony complex, 3 to 15 percent slopes (MXC) occurs on the lower leeward slopes of Haleakalā, between Mākena and Kamaʻole. It consists of Mākena Loam and Stony Land. Stony Land occurs on low ridges and makes up 30 to 60 percent of the complex. Mākena Loam occurs as gently sloping areas between the low ridges of Stony Land.

On the Mākena part of the complex, permeability is moderately slow, runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is about 1.8 inches per foot of soil. On the Stony Land part, permeability is very rapid and there is no erosion hazard. Mākena part is in capability classification VIs, non-irrigated; stony land part is in capability classification VIIs, non-irrigated. Keawakapu, extremely stony silty clay loam (KNXD) occurs on low uplands. This soil series consists of well-drained, extremely stony soils. These soils developed in volcanic ash. Permeability is moderate. Runoff is slow to medium, and the erosion hazard is slight to moderate. Capability classification is VIs, non-irrigated. Oanapuka very stony silt loam, 7 to 25 percent slopes (OAD) occurs on the lower uplands. This soil series consists of well-drained, very stony soils. These soils developed in volcanic ash and material derived from cinders. Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight to moderate. Capability classification is VIs, non-irrigated. Very Stony Land (rVS) consists of young ʻaʻā lava that has a thin covering of volcanic ash that locally extends deep into cracks and depressions. The slope ranges from 7 to 30 percent and occurs in very steep gulches. Soils within the property are illustrated in Figure 3.1.

Figure 3.1 Soil types within the Project boundary



3.4 Hydrology, Drainage and Water Resources

3.4.1 Surface Water

Hydrological processes in Hawaiʻi are highly dependent on the climatic and geological features, and stream flow is influenced by rainfall and wind patterns. The semi-arid area in which the Property is located receives on average an annual rainfall of 18 inches. Because of the relatively dry conditions at and above the area, gulches traversing the Property fill with runoff only during, and briefly following, heavy rainfall events. No perennial streams exist within the project area.

3.4.2 Flooding

The Flood Insurance Rate Map (FIRM) prepared by the Federal Emergency Management Agency's National Flood Insurance Program depicts flood hazard zones throughout the state, and classify lands into four zones depending on the expectation of flood inundation. The majority of the project area is located in flood zone C, which is outside of the 500-year flood plan in an area of minimal flooding.

3.4.3 Groundwater

The project area and the wells that will supply the Project are located within the Kamaʻole Aquifer System, an area delineated and regulated by the State Commission on Water Resource Management (CWRM). This system comprises a wedge-shaped area of approximately 89 square miles with its base along an 11-mile stretch of shoreline from Waiakoa Gulch on the north to Cape Kinaʻu on the south, and its apex at the top of Haleakalā. Based on drilled wells and by geophysical soundings, groundwater in the Kamaʻole Aquifer exists as a basal lens from the shoreline as far inland as the 1,700-foot contour (Tom Nance Water Resources Engineers 2010).

3.5 Environmental Contaminants

A phase I Environmental Site Assessment was conducted for Honuaʻula by LandAmerica Assessment Corporation (2007). This assessment included a site reconnaissance as well as research and interviews with representatives of the public, property ownership, site manager, and regulatory agencies. The Environmental Site Assessment did not reveal any evidence of recognized environmental conditions in connection with the Property, nor did it find any upgradient sites of potential concern to the Property based on review of a database report from Environmental Data Resources for the Property and surrounding areas (LandAmerica, 2007).

3.6 Land Use Designations

Under The State Land Use Law (Act 187), Hawaiʻi Revised Statutes Chapter 205, all lands and waters in the state are classified into one of four districts: Agriculture, Rural, Conservation and Urban. In addition, land use is dictated by the Land Use Ordinance from the City and County.

The State Land Use is classified as Urban; the Property falls within the County and Community Plan Zoning Project District 9, and does not fall within the Special Management Area.

3.7 Vegetation Within the Property

Botanical surveys in context of the proposed activities were conducted by SWCA in March 2008 and in May 2009 (SWCA 2009a). Several preceding surveys have been conducted at the Property since 1988 (Char and Linney 1988; Char 1993, 2004; SWCA 2006; Altenberg 2007). Char and Linney (1988) recorded 132 plant species, including 21 native species, and identified one species proposed for listing as endangered: ʻāwikiwiki (*Canavalia pubescens*). They recommended protection of a small area in the south-western corner of the Property where they found ʻāwikiwiki and other uncommon native plants, but unknown persons subsequently bulldozed the area and all of these plants were lost. SWCA recorded 146 plant species within the boundaries of the Property, 26 of which are native, 14 of these endemic. The remaining 120 plant species are introduced non-native species.

Altenberg (2007) found 20 native plants, including 12 endemic species, and identified four native species not previously recorded by Char and Linney (1988) or Char (1993, 2004): pua kala (*Argemone glauca*), alena (*Boerhavia repens*), akoko (*Euphorbia celastroides var. lorifolia*), and anunu (*Sycios pachycarpus*). However, Char and Linney (1988) and Char (1993, 2004) reported five species not found later by Altenberg (2007): maidenhair fern (*Adiantum capillus-veneris*), *pellaea* (*Pellaea ternifolia*), *kakonakona* (*Panicumtorridum*), *Solanum americanum* (*popolo*) and alena (*Boerhavia repens*). Altenberg (2007) suggested that Honuaʻula contains much of the third-largest contiguous area of wiliwili (*Erythrina sandwichensis*) habitat on Maui and recommended the southwestern 110 acres be protected for its ecological value. Price et al. (2007) assigned values of 'medium' to 'low' habitat quality for wiliwili within the area encompassing the Property on his habitat quality maps, based on bioclimatic data. A number of areas in southeastern Maui located between Puʻu Olai and Kaupo outside the Property did appear on these maps as having 'high' habitat quality for wiliwili (Price et al. 2007).

Char and Linney (1988) divided the vegetation on the Property into three distinct vegetation types: kiawe (*Prosopis pallida*)/buffelgrass (*Cenchrus ciliaris*) pasturelands, gully vegetation, and scrub vegetation. More recent US Geological Service GAP Analysis Program (Figure 3.2) classified land cover within the Property largely as "XT: open kiawe forest and shrubland (alien grasses)", "Y: uncharacterized open-sparse vegetation", with small patches of "XG: alien grassland" and "XT: alien forest". SWCA (2009a) described three distinct vegetation types within the Property: kiawe-buffelgrass grassland, kiawe-wiliwili shrubland, and gulch vegetation, similar to the three categories described by Char and Linney (1988).

About 75% of the northern portion of the project parcel is characterized by an extensive grassland comprised primarily of kiawe (*Prosopis pallida*) and buffelgrass (*Cenchrus ciliaris*). Guinea grass (*Urochloa maxima*), natal redtop (*Rhynchelytrum repens*), and sour grass (*Digitaria insularis*) were also scattered throughout the northern portion of the Property. Other plants found in this area include mostly invasive aliens, most notably koa haole (*Leucaena leucocephala*), lantana (*Lantana camara*), partridge pea (*Chamaecrista nictitans*) and cow pea (*Macroptilium lathyroides*). The area has been disturbed throughout by numerous jeep trails and unrestricted grazing by axis deer. Some open areas that appeared to be heavily grazed were devoid of buffelgrass but contained the native shrubs ʻilima (*Sida fallax*) and hoary abutilon (*Abutilon incanum*), and the introduced golden crown beard (*Verbesina encelioides*). The vast expanse of kiawe-buffelgrass in the northern three quarters of the Property is bisected from east to west by several gulches that carry flood waters to the sea during and briefly after heavy rainfall events. These intermittent gulches vary in depth and are shaded by their steep walls providing relatively cool and moist conditions, resulting in a unique vegetation type. Three species of ferns including maidenhair fern (*Adiantum capillus-veneris*), sword fern (*Nephrolepis multiflora*), and the endemic ʻiwaʻiwa fern (*Doryopteris decipiens*) were found in the shaded rocky outcrops and crevices within the gulches.

Native pili grass (*Heteropogon contortus*) was found in more open and sunny locations around the gulches. Other species found within the gulches include tree tobacco (*Nicotiana glauca*), wiliwili lantana, partridge pea, golden crown-beard (*Verbesina encelioides*), ʻilima (*Sida fallax*), hoary abutilon (*Abutilon incanum*), koa haole (*Leucaena leucocephala*), indigo (*Indigofera suffruticosa*), ʻuhaloa (*Waltheria indica*) and lion's ear (*Leonotis nepetifolia*). Remnant mixed kiawe-wiliwili shrubland was limited to the southern ʻaʻā lava flow in the southern quarter of Property (Figure 6.1). Scattered groves of wiliwili and kiawe trees co-dominated the upper story. Native shrubs, such as ʻilima and maiapilo (*Capparis sandwichiana*), and the native vine ʻānunu (*Sicyos pachycarpus*), were represented in the understory. Ground vegetation in these and all areas was dominated by introduced shrubs, introduced grasses, and introduced vines and herbaceous species. Lantana (*Lantana camara*), found throughout the mixed kiawe-wiliwili shrubland, showed signs of dieback. Guinea grass (*Urochloa maxima*) found on the site, although abundant, was grazed to stubble, probably by axis deer. SWCA conducted a thorough, quantitative assessment of the vegetation on the Property, including spatially explicit information on native species and their distribution. A detailed report of the analysis and findings can be found in Appendix 1. Table 3-1 below lists native plant species recorded on the Property by SWCA (2009a). In addition, surveys were done by SWCA for off-site areas impacted by creation and/or improvements of waterlines, but no significant findings were reported in terms of sensitive or listed native species (SWCA 2009c, 2010b). The proposed offsite areas were surveyed by Xamanek Researches (1994) and no sensitive or native species were documented.

Figure 3.2: Hawaiʻi GAP Land Cover

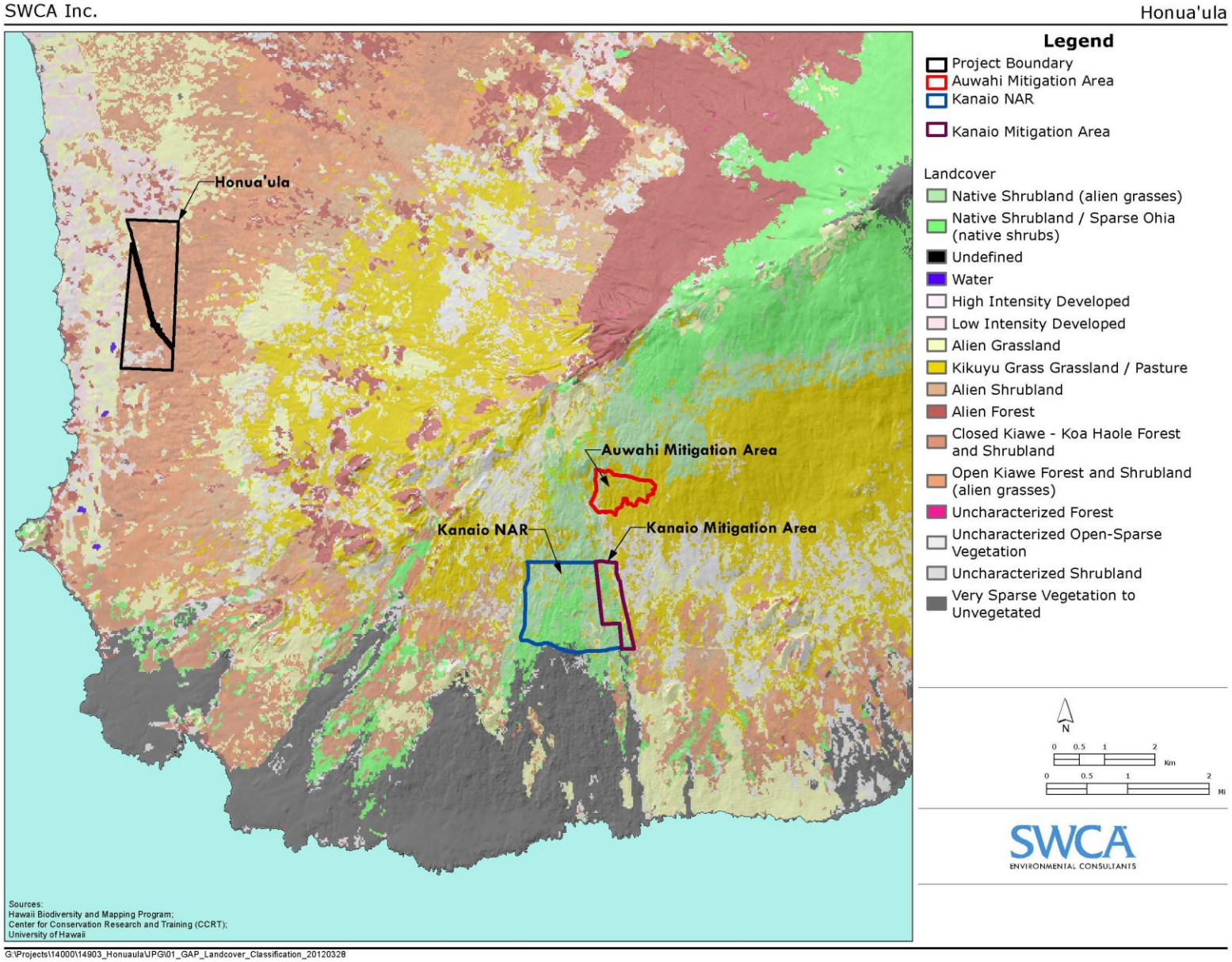


Figure 3.4: Native Plant Count Classes

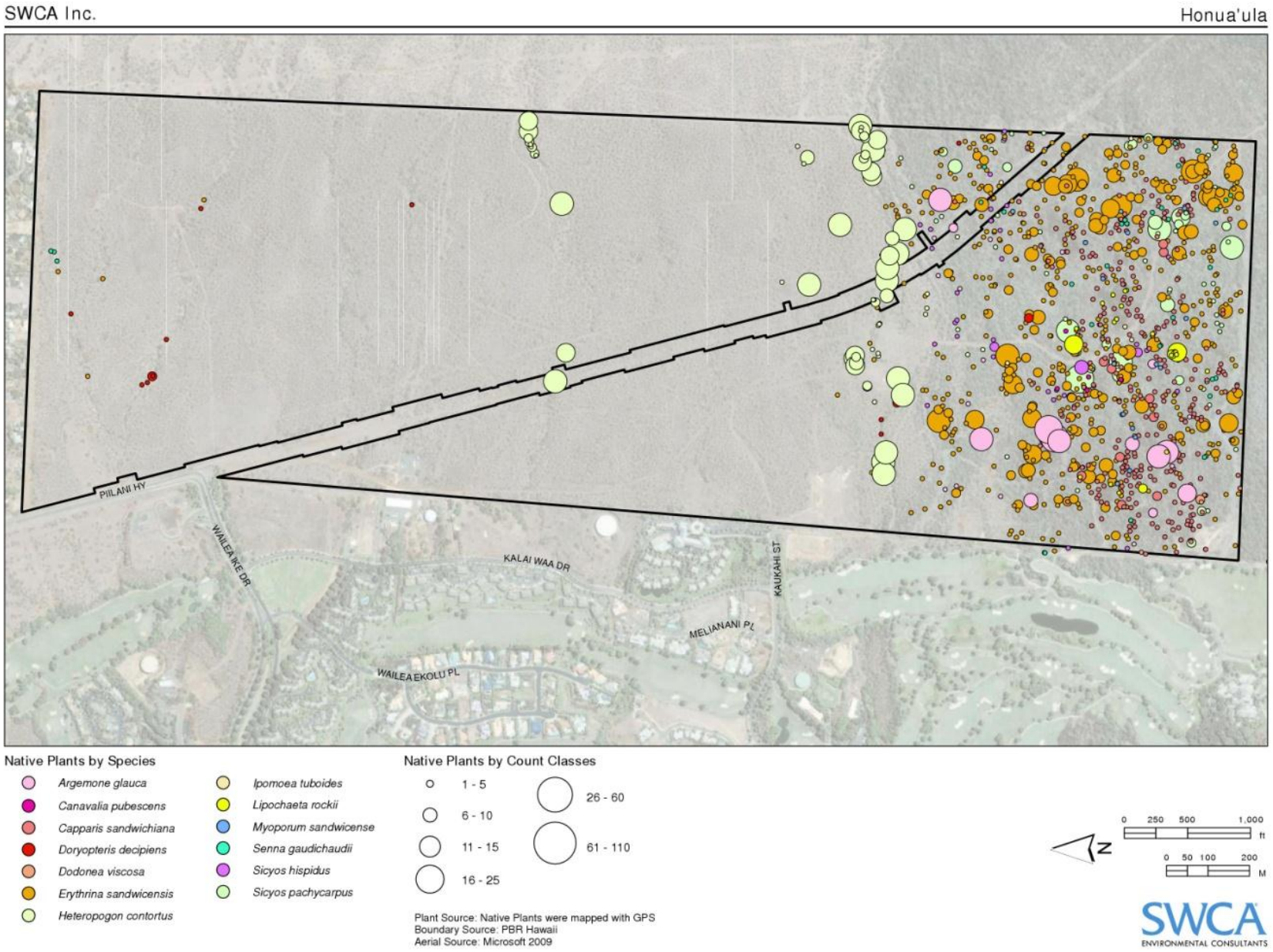


Table 3-1 Native plants reported from the project area arranged in order of their relative importance. Source: SWCA (2009a).

Species	Status	Hawaiian or Common Name	Family
GROUP 1			
Lipochaeta rockii	E	nehe	Asteraceae
Canavalia pubescens	E	ʻāwikiwiki	Fabaceae
Erythrina sandwicensis	E	wiliwili	Fabaceae
Capparis sandwichiana	E	maiapilo	Capparaceae
Senna gaudichaudii	I	kolomona	Leguminoceae
Sicyos hispidus	E	ʻānunu	Cucurbitaceae
Sicyos pachycarpus	E	ʻānunu	Cucurbitaceae
Euphorbia celastroides var. *lorifolia**	E	ʻakoko	Euphorbiaceae
Argemone glauca	E	pua kala	Papavaraceae
GROUP 2			
Myoporum sandwicense	E	naio	Myoporaceae
Panicum torridum	E	kakonakona	Poaceae
Heteropogon contortus	E	pili	Poaceae
Ipomoea tuboides	E	ipomea	Convolvulaceae
Boerhavia herbstii	E	alena	Nyctaginaceae
Doryopteris decipiens	E	ʻiwaʻiwa	Pteridaceae
Plumbago zeylanica	E	ʻilieʻe	Plumbaginaceae
GROUP 3			
Dodonaea viscosa	I	ʻaʻaliʻi	Sapindaceae
Sida fallax	I	ʻilima	Malvaceae
Boerhavia sp.	I	alena	Nyctaginaceae
Abutilon incanum	I	hoary abutilon	Malvaceae
Ipomoea indica	I	koali awahia	Convolvulaceae
Waltheria indica	I	ʻuhaloa	Malvaceae
Pellaea ternifolia	I	pellaea	Pteridaceae
Adiantum capillus-veneris	I	maidenhair fern	Pteridaceae

Group 1 = endemic (E) and indigenous (I) plants uncommon within the project area as well as elsewhere in the State, and/or of significance to life stages of the endangered Blackburn sphinx moth; Group 2 = relatively common endemic species throughout Hawaiʻi Group 3 = relatively common native species throughout Hawaiʻi.
** A single stunted ʻakoko was found within the project area in 2006; however, the plant was found to be dead in the late summer of 2007, and was not found at all during the 2008 surveys. Therefore, it is not considered in further plant density analysis for the purpose of defining boundaries of the native plant preserve.*

Based upon the observed distribution and composition of native plants within the Property, it is apparent that the southern ʻaʻā lava flow, which is demarcated by the stone wall that runs mauka makai across the northern margin of the flow, is a remnant native dry shrubland (Gagne and Cuddihy 1999). Many have stated that native dry forests and dry shrublands are among the most endangered ecosystems in Hawaiʻi, and as some believe, in the world (Rock 1913; Noss et al. 1995; Bruegmann 1996; Allen 2000; Cabin et al. 2000, 2001; Medeiros 2006, Altenberg 2007, 2010). Like many areas within the state, however, the intrinsic ecological significance of this remnant native habitat was not recognized until recently. Previous biological surveys of the Property dating back to the mid-1980 have failed to note this, and no government efforts were ever undertaken to protect this area as a remnant native dry forest. As it passed through numerous public zoning and entitlement processes over the years, the land was converted to urban district and approved for development without expressed concern from any county, state, or federal agency that the Property was of any interest or biological significance whatsoever. The

southern portion of the Property was not recognized as containing components of a native dry shrubland ecosystem until the recent work of SWCA (2006) and Altenberg (2007). However, the Property's condition is most accurately described as highly degraded. As previously noted, the Property is zoned urban and has been slated for development since at least 1988. It has been subject to historic disturbances by wartime training maneuvers and uncontrolled grazing by feral ungulates, and it is crisscrossed by bulldozed access roads.

3.7.1 Listed Plant Species

No Federal or State of Hawaiʻi listed threatened or endangered plant species have been found on the Property (Char and Linney 1988; Char 1993, 2004; SWCA 2006; Altenberg 2007, SWCA 2009a). However, five individual plants of ʻāwikiwiki, a species proposed for listing as endangered have been found within the property.

3.7.1.1 ʻĀwikiwiki

Population, Biology and Distribution of ʻĀwikiwiki. ʻĀwikiwiki is a perennial climbing liana with pubescent, trifoliate leaves. The flowers occur in clusters of 8-20, and are typical of pea-like plants, usually colored a dark red, pink, or purple with a white spot and streaking at the base of the petals. Seed pond are 12-18 cm long (5-7 in), containing large brown to reddish brown seeds. Currently ʻāwikiwiki is uncommon, and used to be found in open, dry sites such as open lava fields, kiawe thickets, and dry forests at 15-540m (49-1770 feet) on Niʻihau, Kauaʻi, Lānaʻi, and leeward East Maui (Wagner et al 1990).

Current Threats to ʻĀwikiwiki. The remaining populations of ʻāwikiwiki on Maui are threatened by feral goats and axis deer that directly predate the plants, and degrade and destroy habitat by destroying native plants and disrupting topsoil, leading to erosion and establishment of introduced and invasive species. Because of anticipated increased impacts resulting from an increasing deer population, ʻāwikiwiki is believed to be in decline.

Occurrence of ʻĀwikiwiki on Maui and at the Property. The current remaining population is estimated at 200 individuals (USFWS 2012), in five scattered populations on East Maui, most of which are located on State lands: Keokea and Puʻu o Kali, Papaka Kai, southeast Pohakea, ʻAhihi Kinaʻu NAR, and Honuaʻula. All plants of this species that formerly were found in the Ahihi-Kinau Natural Area Reserve on Maui were destroyed by feral goats by the end of 2010. Five individual ʻāwikiwiki have been found within the Property by SWCA. All ʻāwikiwiki were flowering and fruiting during surveys conducted in March 2006; January, February and October 2007, and March 2008, and September 2009. The plants appeared to be healthy with no signs of damage or disease. Following the extensive drought in October 2010, ʻāwikiwiki stems at Honuaʻula were dry and leafless; however, seeds in pods were abundantly present on the desiccated vines. No seedlings were observed in subsequent pre- and post-drought reconnaissance surveys conducted by SWCA in the fall of 2010 and spring of 2011.

In 2009, USFWS chose not to pursue immediate issuance of a proposed listing rule for ʻāwikiwiki in lieu of higher priority listing actions, which include other candidate species with lower listing priority numbers (USFWS 2009). However, in 2011, USWFS announced that they expect to publish a proposed listing rule prior to the 2012 annual resubmitted 12-month petition finding (USFWS 2011), and on June 11, 2012 the USFWS proposed listing the species as endangered (USFWS 2012). Therefore the species is expected to become a listed species within the project lifetime. Continued status monitoring will be conducted as new information becomes available. The species is being addressed in this HCP instead of a CCAA (Candidate Conservation Agreement with Assurances) based upon the assumption that it will be listed as endangered in the near future. All five ʻāwikiwiki plants on the Property are proposed for protection within a proposed Native Plant Preservation Area (perpetual preservation easement). Therefore, it is not included as a Covered Species.

3.8 Fauna

3.8.1 Surveys Conducted

Wildlife surveys of the Property were conducted by SWCA in March 2008 and in May 2009 (SWCA 2009b). Several preceding surveys have been conducted at the Property since 1988 (Bruner 1988, 1993, and 2004), in conjunction with above mentioned botanical surveys. During these surveys, no native birds, mammals, or invertebrates were observed on the Property (Bruner 1988, 1993, 2004).

3.8.2 Non-Listed Species

3.8.2.1 Birds

Bruner (1988, 1993, 2004) found no substantial changes in the abundance or composition of alien bird species on the Property between his surveys, encompassing a span of 16 years. In his most recent survey, Bruner (2004) found House finch (*Haemorhous mexicanus*), Japanese white-eye (*Zosterops japonicus*), black francolin (*Francolinus francolinus*), and zebra dove (*Geopelia striata*) to be the most abundant birds on the Property. SWCA recorded 16 species of introduced birds on the Property (Table 3-2). The most abundant alien birds during these surveys were Japanese white-eye (*Zosterops japonicus*), nutmeg manikin (*Lonchura punctulata*), zebra dove (*Geopelia striata*), and northern cardinal (*Cardinalis cardinalis*). Along the southern border of the Property African silverbills (*Lonchura cantans*) and red-crested cardinals (*Paroaria coronata*) were more common (SWCA 2009b). SWCA (2009b) recorded four alien bird species that were not recorded by Bruner (1988, 1993, and 2004): cattle egret (*Bulbulcus ibis*), mourning doves (*Zenaida macroura*), chestnut munias (*Lonchura atricapilla*), and Erckel's francolin (*Francolinus erckelli*). The latter was based on an auditory observation. This species has never before been recorded from Maui, and this observation may represent a misidentification. These birds were relatively rare. In addition, surveys were done by SWCA for off-site areas impacted by creation and/or improvements of waterlines, but no significant findings were reported in terms of sensitive or listed native species (SWCA 2009b). Additional surveys were conducted by Xamanek Researches (1994) and no sensitive or native species were documented.

Besides the Hawaiian short-eared owl, or pueo (*Asio flammeus sandwichensis*), the only resident native bird detected on the Property is the cosmopolitan black-crowned night heron, or aukuʻu (*Nycticorax nycticorax*). One black-crowned night heron was observed flying across the Property (SWCA 2009b). Visiting migratory species were seen on the Property during chance, or opportunistic sightings. SWCA biologists have seen Pacific golden plovers (*Pluvialis fulva*) on several occasions during the winter months on lawns and golf courses adjacent to the Property, and Bruner (1988) recorded one Pacific golden plover during his February 1988 survey of the Property. One northern harrier (*Circus cyaneus*), which is not commonly sighted in the Hawaiian Islands, was seen flying over the Property in 2006 by an SWCA biologist (SWCA 2009b).

Although seabirds spend most of their time over the ocean, they nest on land, and may fly over the Property to and from their nesting sites, or in search of fresh water or thermals. Non-listed seabirds that may be seen over the Property include the great frigatebird (*Fregata minor*) and tropicbirds (*Phaeton* spp.).

Table 3-2: Bird species and relative abundance observed on the Honuaʻula Project site during SWCA's (2009b) bird surveys in May and September 2008.

Species	Common Name	Status	Birds per point count (n=30)	Abundance Rank
Asio flammeus sandwichensis	Pueo	N (NR)	x	-
Bubulcus ibis	Cattle Egret	I (NR)	x	-
Zenaida macroura	Mourning Dove	I (NR)	0.03	12
Francolinus erckelli[1]	Erckel's Francolin	I (NR)	0.03	12
Francolinus pondicerianus	Gray Francolin	I	0.23	9
Francolinus francolinus	Black Francolin	I	0.73	5
Streptopelia chinensis	Spotted Dove	I	0.30	7
Geopelia striata	Zebra Dove	I	1.70	3
Tyto alba	Barn owl	I	x	-
Zosterops japonicus	Japanese White eye	I	3.50	1
Mimus polyglottos	Common Mockingbird	I	0.03	12
Acridotheres tristis	Common Myna	I	0.07	11
Cardinalis cardinalis	Northern Cardinal	I	1.3	4
Carpodacus mexicanus	House Finch	I	0.23	9
Lonchura punctulata	Nutmeg Mannikin	I	3.03	2
Lonchura atricapilla	Chestnut Munia	I (NR)	x	-
Lonchura cantans	African Silverbill	I	0.67	6

I = introduced, N = native NR = new record since 2004
X - observed outside point counts

[1]This was a single auditory observation outside of the point counts. This species has never before been recorded on Maui, and this is likely a misidentification.

3.8.2.2 Hawaiian Short-eared Owl or Pueo

Population, Biology and Distribution of Pueo. The Hawaiian short-eared owl is an endemic subspecies of the nearly cosmopolitan short-eared owl (*Asio flammeus*). This is the only extant owl native to Hawaiʻi and is found on all the main islands from sea level to 8,000 ft (2,450 m). The Hawaiian short-eared owl is listed by the State of Hawaiʻi as endangered on the Island of Oʻahu, but not listed on Maui.

Unlike most owls, Hawaiian short-eared owls are active during the day (Mostello 1996; Mitchell et al. 2005), though nocturnal or crepuscular activity has also been documented (Mostello 1996). Hawaiian short-eared owls are commonly seen hovering or soaring over open areas (Mitchell et al. 2005).

No surveys have been conducted to date to estimate the population size of Hawaiian short-eared owl. The species was widespread at the end of the 19th century, but numbers are thought to be declining (Mostello 1996; Mitchell et al. 2005).

Hawaiian short-eared owl occupy a variety of habitats, including wet and dry forests, but are most common in open habitats, such as grasslands, shrublands and montane parklands, including urban areas and those actively managed for conservation (Mitchell et al. 2005). Evidence indicates the owls became established in Hawaiʻi in relatively recent history, with their population likely tied to the introduction of Polynesian rats (*Rattus exulans*) to the islands by Polynesians.

Pellet analyses indicate that rodents, birds and insects, respectively, are their most common prey items of Hawaiian short-eared owls (Snetsinger et al. 1994; Mostello 1996). Hawaiian short-eared owl prey includes passerines, seabirds and shorebirds (Snetsinger et al. 1994; Mostello 1996; Mounce 2008). The Hawaiian short-eared owl relies more heavily on birds and insects than its continental relatives (Snetsinger et al. 1994), likely because of the low rodent diversity of the Hawaiian Islands (Mostello 1996).

Hawaiian short-eared owls nest on the ground. Little is known about their breeding biology, but nests have been found throughout the year. Nests are constructed by females and consist of simple scrapes in the ground lined with grasses and feather down. Females perform all incubating and brooding, while males feed females and defend nests. The young may leave the nest on foot before they are able to fly and depend on their parents for approximately two months (Mitchell et al. 2005).

Current Threats to Pueo. Loss and degradation of habitat, predation by introduced mammals, and disease threaten the Hawaiian short-eared owl. Hawaiian short-eared owls appear particularly sensitive to habitat loss and fragmentation. Ground nesting birds are more susceptible to the increased predation pressure that is typical within fragmented habitats and near rural developments (Wiggins et al. 2006). These nesting habits make them increasingly vulnerable to predation by rats, cats and the small Indian mongoose (Mostello 1996; Mitchell et al. 2005).

Some mortality of Hawaiian short-eared owls on Kauaʻi has been attributed to "sick owl syndrome," which may be caused by pesticide poisoning or food shortages. They may be vulnerable to the ingestion of poisoned rodents. However, in the one study on mortality that has been conducted, no evidence was found that organochlorine, organophosphorus, or carbamate pesticides caused mortality in Hawaiian short-eared owls (Thierry and Hale 1996). Other causes of death on Maui, Oʻahu, and Kauaʻi have been attributed to trauma (apparently vehicular collisions), emaciation, and infectious disease (pasteurellosis) (Thierry and Hale 1996). However, persistence of these owls in lowland, non-native and rangeland habitats suggests that they may be less vulnerable to extinction than other native birds. This is likely because they may be resistant to avian malaria and avian pox (Mitchell et al. 2005), and because they are opportunistic predators that feed on a wide range of small animals.

Occurrence of Pueo on Maui and at the Property. Six pueo have been observed on the Property over the course of SWCA's wildlife surveys (2009b) and associated field trips (Figure 3.4). Twelve (12) barn owls (*Tyto alba*) and six other unidentified owls have been sighted in the kiawe-buffelgrass grasslands in the northern portion of the Property. No pueo or barn owls have been sighted in the southern kiawe-wiliwili shrubland, and no nests were found anywhere on the Property. Bruner (1988, 1993, and 2004) did not record any pueo in the Property during any of his surveys.

3.8.2.3 Herpetofauna

There are no native land reptiles or amphibians in Hawaiʻi (McKeown 1996). Geckos (Gekkonidae) were heard calling by SWCA (2009b) on the Property and along jeep roads on the southern border of the Property, but were not seen. No skinks (Scincidae) or amphibians have been recorded at the Property.

3.8.2.4 Mammals

Historically, the Property has been exposed to cattle (*Bos taurus*) grazing. Feral goats (*Capra hircus*) and axis deer (*Axis axis*) have had unrestricted access to the Property and pose a serious threat to the native plant species and the integrity of the remnant mixed kiawe-wiliwili shrubland. Recently, Honuaʻula Partners, LLC constructed a cattle fence preventing cattle from entering the kiawe-wiliwili shrubland in the southern portion of the Property, but cattle are still occasionally grazed within the northern portion of the Property and more regularly east of the Property on lands owned by Ulupalakua Ranch. SWCA (2009b) did not record presence or evidence of cattle, but following their survey cattle were allowed to graze within the northern kiawe-buffelgrass lands on the Property. Small herds of 4 to 30 axis deer were commonly seen during recent surveys of the

Property (SWCA 2009b), and deer scat, tracks, and evidence of buck rubs (rubbing of antlers on trees) were commonly seen. Deer have also been recorded on the Property by Bruner (1988, 1993, and 2004). Although there are reports of goats on the Property, none were observed during any of the surveys. Mongoose (*Herpestes javanicus*) have been recorded on the Property by Bruner (1988, 1993, and 2004), and have more recently been observed on the Property by SWCA biologists. Other small mammals, including cats (*Felis catus*), rats (*Rattus* spp.), and mice (*Mus musculus*), are likely present on the Property due to its proximity to the Maui Meadows subdivision and the Wailea Resort (Figure 1.1). The fact that they have not been recorded on the Property may be due to their nocturnal, secretive, and cryptic nature. Rodent remains have been detected in owl pellets found on the Property.

3.8.3 Listed Wildlife Species with no requested take

None of the four endangered Hawaiian waterbird species or the two endangered seabird species are known to occur within the Property, and no suitable habitat for these species exists there. However, these six species may be attracted to portions of the Property (USFWS 1995) following construction. Although no water features are planned for the golf course, the waterbirds may be attracted to golf course fairways and greens, and juvenile seabirds may be attracted and disoriented by lights on the Property.

The Hawaiian hoary bat has been observed only once at the Property (SWCA 2009b), and low numbers of bats, if any, may use trees within the property for roosting and/or pupping.

3.8.3.1 Hawaiian Hoary Bat

Population, Biology and Distribution of the Hoary Bat. The Hawaiian hoary bat is the only existing native terrestrial mammal from the Hawaiian archipelago (USFWS 1998). The species has been recorded on Kauaʻi, Oʻahu, Molokaʻi, Maui, and Hawaiʻi, but no historical population estimates or information exist for this subspecies. Population estimates for all islands in the state in the recent past have ranged from hundreds to a few thousand bats (Menard 2001). The Hawaiian hoary bat is believed to occur primarily below an elevation of 4,000 feet (1,220 m). This subspecies has been recorded between sea level and approximately 9,050 feet (2,760 m) in elevation on Maui, with most records occurring at or below approximately 2,060 feet (628 m) (USFWS 1998).

Hawaiian hoary bats roost in native and non-native vegetation from 3 to 29 feet (1 to 9 m) above ground level. They have been observed roosting in ʻōhiʻa, hala (*Pandanus tectorius*), and coconut palms (*Cocos nucifera*), kukui (*Aleurites moluccana*), kiawe (*Proscopis pallida*), avocado (*Persea americana*), mango (*Mangifera indica*), shower trees (*Cassia javanica*), pūkiawe *(Leptecophylla tameiameiae*), and fern clumps; they are also suspected to roost in eucalyptus (*Eucalyptus* spp.) and Sugi pine (*Cyrptomeria japonica*) stands. The species is rarely observed using lava tubes, cracks in rocks, or man-made structures for roosting. While roosting during the day, Hawaiian hoary bat are solitary, although mothers and pups roost together (USFWS 1998). Home range sizes of Hawaiian hoary bats vary, and core areas often include nighttime roosts, but not daytime roosts. Roosting and feeding may be disjunctive, as indicated by the long average length of calculated home ranges (USGS, unpublished data).

It is thought that breeding occurs primarily between April and August. Breeding has only been documented on the islands of Hawaiʻi and Kauaʻi (Baldwin 1950; Kepler and Scott 1990; Menard 2001). It is not known whether bats observed on other islands breed locally or only visit these islands during non-breeding periods. Seasonal changes in the abundance of Hawaiian hoary bats at different elevations indicate that altitudinal migrations occur on the Island of Hawaiʻi. During the breeding period, Hawaiian hoary bat occurrences increase in the lowlands and decrease at high elevation habitats. Hawaiian hoary bat occurrences are especially low from June until August in high elevation areas. In the winter, especially during the post-lactation period in October, bat occurrences increase in high elevation areas and in the central highlands, possibly receiving bats from the lowlands (Menard 2001).

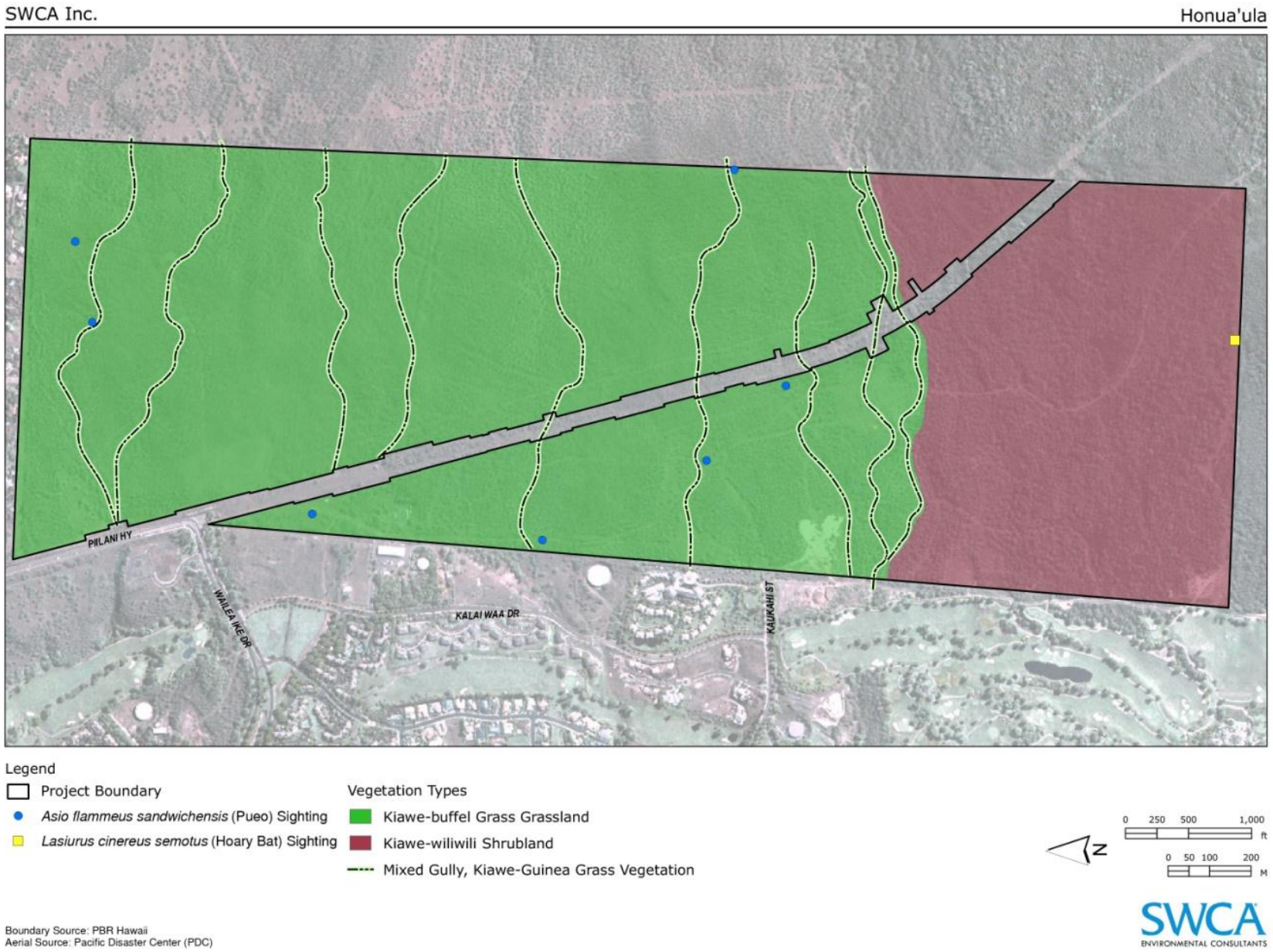
Hawaiian hoary bats feed on a variety of native and non-native night-flying insects, including moths, beetles, crickets, mosquitoes and termites (Whitaker and Tomich 1983). They appear to

prefer moths ranging between 0.60 and 0.89 inches (16 to 20 mm) in size (Bellwood and Fullard 1984; Fullard 2001). Prey is located using echolocation. Water courses and edges (e.g., coastlines and forest/pasture boundaries) appear to be important foraging areas. In addition, the species is attracted to insects that congregate near lights (USFWS 1998; Mitchell et al. 2005). They begin foraging either just before or after sunset depending on the time of year (USFWS 1998; Mitchell et al. 2005).

Current Threats to the Hoary Bat. The availability of roosting sites is believed to be a major limitation in many bat species. Possible threats to the Hawaiian hoary bat include pesticides (either directly or by impacting prey species), predation, alteration of prey availability due to the introduction of non-native insects, and roost disturbance (USFWS 1998). Management of the Hawaiian hoary bat is also limited by a lack of information on key roosting and foraging areas, food habits, seasonal movements and reliable population estimates (USFWS 1998).

Occurrence of the Hoary Bat on Maui and at the Property. On Maui, the bat is believed to occur primarily in moist, forested areas, although little is known about its exact distribution and habitat use on the island. SWCA biologists sighted a single Hawaiian hoary bat at the southern boundary of the project area flying seaward at 18:44 hours on September 19, 2008 (Figure 3.4). Echolocation calls from this individual were simultaneously recorded on the Anabat detector. No other sightings of bats have been made at the Property, and no evidence of roosting or foraging has been observed.

Figure 3.4: Owl and bat sightings on the Property



3.8.3.2 Hawaiian Petrel

Population, Biology and Distribution of Hawaiian Petrels. Hawaiian petrel was once abundant on all main Hawaiian Islands except Niʻihau (Mitchell et al. 2005). The population was most recently estimated to be approximately 20,000, with 4,000 to 5,000 breeding pairs (Mitchell et al. 2005). Today, Hawaiian petrels continue to breed in high-elevation colonies on Maui, Hawaiʻi, Kauaʻi and Lānaʻi (Richardson and Woodside 1954; Simons and Hodges 1998; Telfer et al. 1987). Radar studies conducted in 2002 also suggest that breeding may occur on Molokaʻi (Day and Cooper 2002). It is believed that breeding no longer occurs on Oʻahu (Harrison 1990).

Survey work at a recently re-discovered Hawaiian petrel colony on Lānaʻi, that had been previously thought to be extirpated, indicates that thousands of birds are present, rather than hundreds of birds as first assumed; and that the size of the breeding colony approaches that at Haleakalā, Maui, where as many as 1,000 pairs have been thought to nest annually (Mitchell et al. 2005; Tetra Tech EC, Inc. 2008a, 2008b). Hawaiian petrels are nocturnal and subsist primarily on squid, fish and crustaceans caught near the sea surface. Unlike shearwaters, Hawaiian petrels are not known to dive or swim below the surface (Pitman 1986). Foraging may take place thousands of kilometers from their home islands during both breeding and non-breeding seasons (Spear et al. 1995). In fact, recent studies conducted using satellites and transmitters attached to Hawaiian petrels have shown that they can range across more than 6,200 miles (10,000 km) during two-week foraging expeditions (Adams 2008).

Hawaiian petrels are active in their nesting colonies for about eight months each year. The birds are long-lived (ca. 30 years) and return to the same nesting burrows each year between March and April. Present-day Hawaiian petrel colonies are typically located at high elevations above 2,500 meters (8,200 ft). The types of habitats used for nesting are very diverse and range from xeric habitats with little or no vegetation, such as at Haleakalā National Park on Maui, to wet forests dominated by ʻōhiʻa with uluhe understory as those found on Kauaʻi (Mitchell et al. 2005). Females lay only one egg per year, which is incubated alternately by both parents for approximately 55 days. Eggs hatch in June or July, after which both adults fly to sea to feed and return to feed the nestling. The fledged young depart for sea in October and November. Adult birds do not breed until age six and may not breed every year, but pre-breeding and non-breeding birds nevertheless return to the colony each year to socialize.

Current Threats to Hawaiian Petrels. The most serious land-based threat to the species is predation of eggs and young in the breeding colonies by introduced mammalian predators such as small Indian mongoose, feral cats, owls, pigs, dogs and rats. Population modeling by Simons (1984) suggests that this species could face extinction in a few decades if predation is not controlled. Intensive trapping and habitat protection has helped to improve nesting and fledging success (Ainley et al. 1997). Hodges and Nagata (2001) found that nesting activity (signs of burrow activity) in sites protected from predators on Haleakalā ranged from 37.25% to 78.13% while nesting activity in unprotected sites ranged from 23.08 to 88.17%. Nesting success (proportion of active burrows that showed signs of fledging chicks) in protected sites ranged from 16.97% to 50.00%, while nesting success in unprotected sites ranges from 0.00 to 44.00% averaging 42.4% and 27.1% respectively (Hodges and Nagata 2001).

Ungulates can indirectly affect nesting seabirds by overgrazing and trampling vegetation, as well as facilitating erosion. Climatic events such as El Niño can also impact the reproductive success of seabirds (Hodges and Nagata 2001). Other threats include occasional mortality from collisions with power lines, fences, and other structures near breeding sites or attraction to bright lights. In addition, juvenile birds are sometimes grounded when they become disoriented by lights on their nocturnal first flight from inland breeding sites to the ocean. A few, mostly juvenile, Hawaiian petrels have landed in brightly lighted areas at scattered locations on Maui most years. The problem is much smaller than the one involving Newell's shearwaters, and Simons and Hodges (1998) conclude that it is probably not a threat to remaining populations.

Occurrence of Hawaiian Petrels on Maui and at the Property. Haleakalā supports the largest known nesting colony of Hawaiian petrels (USFWS 2005; Hodges and Nagata 2001). Approximately 1,000 known nests are within the crater of the dormant shield volcano, with the highest concentration on

the western rim between 2,400 and 3,055 m elevation. This population estimate may be an underestimate according to Cooper and Day (2003). The highest densities of nests (15-30 burrows per hectare) occur within Haleakalā National Park. Predator trapping is conducted year-round to reduce predation pressure on these burrows. Lower densities of nesting burrows occur elsewhere in the crater and beyond the park boundaries, but these are currently not actively managed (Hodges and Nagata 2001). Radar studies indicate that the majority of petrels flying inland towards their nesting sites on Haleakalā choose a flight path that may minimize their overland flight, and the number of birds recorded flying over Mākena were relatively low (Cooper & Day 2003). No Hawaiian Petrels have been observed at the Property during any of the surveys.

3.8.3.3 Newell's Shearwater

Population, Biology, and Distribution of Newell's Shearwater. The Newell's shearwater is an endemic Hawaiian sub-species of the nominate species Townsend's shearwater (*Puffinus a. auricularis*) of the eastern Pacific. The Newell's shearwater is considered "Highly Imperiled" in the Regional Seabird Conservation Plan (USFWS 2005) and the North American Waterbird Conservation Plan (Kushlan et al. 2002). Species identified as "Highly Imperiled" have suffered significant population declines and have either low populations or some other high risk factor.

The most recent population estimate of Newell's shearwater was approximately 84,000 birds, with a possible range of 57,000 to 115,000 birds (Ainley et al. 1997). The largest breeding population of Newell's shearwater occurs on Kauaʻi (Telfer et al. 1987; Day and Cooper 1995; Ainley et al. 1995, 1997b; Day et al. 2003). Breeding also occurs on Hawaiʻi Island (Reynolds and Richotte 1997; Reynolds et al. 1997; Day et al. 2003a) and almost certainly occurs on Molokaʻi (Pratt 1988; Day and Cooper 2002). Recent radar studies suggest the species may also nest on Oʻahu (Day and Cooper 2008).

Newell's shearwaters typically nest on steep slopes vegetated by uluhe fern (*Dicranopteris linearis*) undergrowth and scattered ʻōhiʻa (*Metrosideros polymorpha*) trees. Currently, most Newell's shearwater colonies are found from 525 to 3,900 feet (160 to 1,200 m) above mean sea level, often in isolated locations and/or on slopes greater than 65 degrees (Ainley et al. 1997). The birds nest in short burrows excavated into crumbly volcanic rock and ground, usually under dense vegetation and at the base of trees. A single egg is laid in the burrow and one adult bird incubates the egg while the second adult goes to sea to feed. Once the chick has hatched and is large enough to withstand the cool temperatures of the mountains, both parents go to sea and return irregularly to feed the chick. The closely related Manx shearwater is fed every 1.2-1.3 days (Ainley et al. 1997). Newell's shearwaters arrive at and leave their burrows during darkness and birds are seldom seen near land during daylight hours. During the day, adults remain either in their burrows or at sea some distance from land.

First breeding occurs at approximately six years of age, after which breeding pairs produce one egg in a given year. A high rate of non-breeding is found among experienced adults that occupy breeding colonies during the summer breeding season, similar to some other seabird species (Ainley et al. 2001). No specific data exist on longevity for this species, but other shearwaters may reach 30 years of age or more (see for example Bradley et al., 1989, del Hoyo et al. 1992).

The Newell's shearwater breeding season begins in April, when birds return to prospect for nest sites. A pre-laying exodus follows in late April and possibly May; egg-laying begins in the first two weeks of June and likely continues through the early part of July. Pairs produce one egg, and the average incubation period is thought to be approximately 51 days (Telfer 1986). The fledging period is approximately 90 days, and most fledging takes place in October and November, with a few birds still fledging into December (SOS Unpubl. data).

Current Threats to Newell's Shearwater. Radar studies on Kauaʻi show a 63% decrease in detections of shearwaters between 1993 and 2001 (Day et al. 2003a). It was presumed that the decrease in detections corresponded to an actual decrease in population, rather than simply a shift in areas used for breeding. Declines in Newell's shearwater populations are attributed to loss of nesting habitat, predation by introduced mammals (mongoose, feral cats, rats, and feral pigs) at

nesting sites, and fallout of juvenile birds associated with disorientation from urban lighting (Ainley et al. 1997; Mitchell et al. 2005; Hays and Conant 2007).

Occurrence of Newell's Shearwater on Maui and at the Property. The Newell's shearwater was first discovered on Maui when several birds of the species were taken to Mr. M. Newell by Hawaiians in 1894 (Sincock and Swedberg, 1969). In 1931, Peters (1931) considered the species extinct. According to Munro (1944) any possible remnant colonies would be located on Kauaʻi, which was the only major island from which mongoose were absent, but in 1954 an adult Newell's shearwater was recovered from a sugar mill in ʻAiea, Oʻahu (Richardson 1955). Sincock and Swedberg (1969) were the first to reconfirm breeding on Kauaʻi. There is no indisputable evidence of Newell's shearwater nesting on Maui (Ainley et al. 1997). In 1983, one live bird was found near Peahi Reservoir in eastern Maui on July 13, 1983 (Pyle 1983). Further evidence comes from a very small number of grounded juveniles during the fall fledging season on Maui, but it is unclear whether these fledged from Maui or if these were individuals from other islands that were attracted by coastal lights. On average, one fledgling is found on the island per year (Cooper and Day 2003). Radar observations further suggest that small numbers of Newell's shearwater may be nesting inland in eastern and western Maui (Cooper and Day 2003), but more study is needed to unequivocally confirm the presence of breeding Newell's shearwater on Maui. No Newell's shearwaters were observed at the Property during any of the surveys.

3.8.3.4 Hawaiian Stilt

Population, Biology and Distribution of the Hawaiian Stilt. The Hawaiian stilt is a non-migratory endemic subspecies of the black-necked stilt (*Himantopus mexicanus mexicanus*). The black-necked stilt occurs in the western and southern portions of North America, southward through Central America, West Indies, to southern South America and also the Hawaiian Archipelago (Robinson et al. 1999). Hawaiian stilt and black-necked stilt are part of a super-species complex of stilts found in various parts of the world (Pratt et al. 1987; Robinson et al. 1999). The *U.S. Pacific Islands Regional Shorebird Conservation Plan* considers the Hawaiian stilt as highly imperiled because of its low population level (Engilis and Naughton 2004). Over the past 25 years, the Hawaiian stilt population has shown a general upward trend statewide. Annual summer and winter counts have shown variability from year to year. This fluctuation can be attributed to winter rainfall and variation in reproductive success (Engilis and Pratt 1993; USFWS 2005a). The state population size has recently fluctuated between 1,200 to 1,500 individuals with a five-year average of 1,350 birds (USFWS 2005a). Adult and juvenile dispersal has been observed both intra- and inter-island within the state (Reed et al. 1998).

Oʻahu supports the largest number of stilts in the state, with an estimated 35 to 50% of the population residing on the island. Some of the largest concentrations can be found at the James Campbell NWR, Kahuku aquaculture ponds, Pearl Harbor NWR, and Nuʻupia Ponds in Kāneʻohe (USFWS 2005a). The Kiʻi Unit of the James Campbell NWR, and the Waiawa Unit and Pond 2 of the Honouliuli Unit of the Pearl Harbor NWR are the most productive stilt habitats, with birds numbering near 100 or above during survey counts (USFWS 2002; USFWS unpubl. data). Hatching success of stilt nests has been greater than 80% in the Kiʻi Unit, but chick mortality rates are high (USFWS 2002).

Hawaiian stilts favor open wetland habitats with minimal vegetative cover and water depths of less than 9.4 inches (24 cm), as well as tidal mudflats (Robinson et al. 1999). Stilts feed on small fish, crabs, polychaete worms, terrestrial and aquatic insects, and tadpoles (Robinson et al. 1999; Rauzon and Drigot 2002). Hawaiian stilts tend to be opportunistic users of ephemeral wetlands to exploit the seasonal abundance of food (Berger 1972; USFWS 2005a). Hawaiian stilts nest from mid-February through late August with variable peak nesting from year to year (Robinson et al. 1999). Nesting sites for stilts consist of simple scrapes on low relief islands within and/or adjacent to ponds. Clutch size averages four eggs (Hawaiʻi Audubon Society 2005; USFWS 2005a).

Current Threats to the Hawaiian Stilt. The most important causes of decline of the Hawaiian stilt and other Hawaiian waterbirds is the loss of wetland habitat and predation by introduced animals. Barn owls and the endemic Hawaiian short-eared owl are known predators of adult stilts and possibly their young (Robinson et al. 1999; USFWS 2005a). Known predators of eggs, nestlings,

and/or young stilts include small Indian mongoose, feral cat, rats, feral and domestic dogs, black crowned night-heron, cattle egret, common mynah, ruddy turnstone, laughing gull (*Larus atricilla*), American bullfrog (*Rana catesbeiana*), and large fish (Robinson et al. 1999; USFWS 2005a). A study conducted at the Kiʻi Unit of the James Campbell NWR between 2003 and 2004 attributed 45% of stilt chick losses to bullfrog predation over the two breeding periods (USFWS, unpublished data). The Kiʻi Unit has on-going control programs for mongoose, feral cats, rats, cane toads (*Bufo marinus*), and bullfrogs (Silbernagle/USFWS, pers. comm.). Other factors that have contributed to population declines in Hawaiian stilts include altered hydrology, alteration of habitat by invasive non-native plants, disease, and possibly environmental contaminants (USFWS 2005a). Although the Hawaiian stilt is considered imperiled, it is believed to have high recovery potential with a moderate degree of threat.

Occurrence of Hawaiian Stilt on Maui and at the Property. The Maui population of Hawaiian stilts has ranged between approximately 250 and 530 birds, and is largely supported by Maui's two large coastal wetlands: Kealia and Kanahā. The most important nesting habitat is at Kealia, and small numbers of stilts also frequent aquaculture facilities on the island (USFWS 2005). Stilts are highly mobile and monthly counts indicate that birds move freely between wetlands, likely in search of optimal foraging habitat (Ueoka 1997). No Hawaiian stilts were observed at the Property during any of the surveys.

3.8.3.5 Hawaiian Coot

Population, Biology and Distribution of the Hawaiian Coot. The Hawaiian coot is an endangered species endemic to the main Hawaiian Islands, except Kahoʻolawe. The Hawaiian coot is non-migratory and believed to have originated from migrant American coots (*Fulica americana*) that strayed from North America. The species is an occasional vagrant to the northwestern Hawaiian Islands west to Kure Atoll (Pratt et al. 1987; Brisbin et al. 2002).

The population of Hawaiian coot has fluctuated between 2,000 and 4,000 birds. Of this total, roughly 80% occur on Oʻahu, Maui, and Kauaʻi (Engilis and Pratt 1993; USFWS 2005a). The Oʻahu population fluctuates between approximately 500 to 1,000 birds. Hawaiian coots occur regularly in the Kiʻi Unit of the James Campbell NWR, with peak counts in 2005 and 2006 reaching nearly 350 birds (USFWS 2002, 2005a, unpubl. data). Population fluctuations in these areas are attributed to seasonal rainfall and variation in reproductive success. Inter-island dispersal has been noted and is presumably influenced by seasonal rainfall patterns and food abundance (USFWS 2005a).

Coots are usually found on the coastal plain of islands and prefer freshwater ponds or wetlands, brackish wetlands, and man-made impoundments. They prefer open water that is less than 11.8 inches (30 cm) deep for foraging. Preferred nesting habitat has open water with emergent aquatic vegetation or heavy stands of grass (Schwartz and Schwartz 1949; Brisbin et al. 2002; USFWS 2005a). Nesting occurs mostly from March through September, with opportunistic nesting occurring year round depending on rainfall. Hawaiian coots will construct floating nests of aquatic vegetation, semi-floating nests attached to emergent vegetation or nests in clumps of wetland vegetation (Brisbin et al. 2002; USFWS 2005a). False nests are also sometimes constructed and used for resting or as brooding platforms (USFWS 2005a). Coots feed on seeds, roots and leaves of aquatic and terrestrial plants, freshwater snails, crustaceans, tadpoles of bullfrogs and marine toads, small fish, and aquatic and terrestrial insects (Schwartz and Schwartz 1949; Brisbin et al. 2002).

Current Threats to the Hawaiian Coot. Similar to the other listed waterbirds, the recovery of the Hawaiian coot is limited by habitat loss and degradation (USFWS 2005(a)). According to the USFWS *Second Draft Recovery Plan for Hawaiian Waterbirds* (2005a) the Hawaiian coot has a high potential for recovery and a low degree of threats (USFWS 2005a). Introduced feral cats, feral and domestic dogs, and mongoose are the main predators of adult and young Hawaiian coots (Brisbin et al. 2002; Winter 2003). Other predators of young coots include black-crowned night heron, cattle egret and large fish. Coots are susceptible to avian botulism outbreaks in the Hawaiian Islands (Brisbin et al. 2002).

Occurrence of the Hawaiian Coot on Maui and at the Property. The population of Hawaiian coot on Maui has fluctuated between approximately 200-600 birds, with the largest concentrations found at Kanahā and Kealia ponds. The species is highly mobile and individuals move frequently between these wetlands (USFWS 2005a). No Hawaiian coots were observed at the Property during any of the surveys.

3.8.3.6 Hawaiian Duck

Population, Biology and Distribution of the Hawaiian Duck. The Hawaiian duck is a non-migratory species endemic to the Hawaiian Islands, and the only endemic duck extant in the main Hawaiian Islands (Uyehara et al. 2008). The Hawaiian duck is a small, mottled brown duck with emerald green to blue patches on their wings (speculums). Males are typically larger, have distinctive dark brown chevrons on the breast feathers, an olive-colored bill, and bright orange feet. Females are slightly smaller and lighter in color (Evans et al. 1994; USFWS 2005a). Compared to feral mallard ducks, Hawaiian ducks are more cryptic and about 20 to 30% smaller (Uyehara et al. 2007).

The historical range of the Hawaiian duck includes all the main Hawaiian Islands, except for the Islands of Lānaʻi and Kahoʻolawe. Hawaiian ducks are strong flyers and usually fly at low altitudes. Intra-island movement has been recorded, where they may move between ephemeral wetlands or disperse to montane areas during the breeding season (Engilis et al. 2002). Hawaiian ducks also fly inter-island and have been documented to fly regularly between Niʻihau and Kauaʻi in response to above-normal precipitation and the flooding and drying of Niʻihau's ephemeral wetlands (USFWS 2005a). Hawaiian ducks occur in aquatic habitats up to an altitude of 10,000 ft (3,048 m) in elevation (Uyehara et al. 2007). The only naturally occurring population of Hawaiian duck exists on Kauaʻi, with reintroduced populations on Oʻahu, Hawaiʻi and Maui (Pratt et al. 1987; Engilis et al. 2002; Hawaiʻi Audubon Society 2005).

Hawaiian ducks are closely related to mallards (Browne et al. 1993). Due to this close genetic relationship, Hawaiian ducks will readily hybridize with mallards and allozyme data indicate there has been extensive hybridization between Hawaiian duck and feral mallards on Oʻahu, with the near disappearance of Hawaiian duck alleles from the population on the island (Browne et al. 1993). Uyehara et al. (2007) found a predominance of hybrids on Oʻahu and samples collected by Browne et al. (1993) from ducks and eggs at the Kiʻi Unit of the James Campbell NWR found mallard genotypes. In 2005, a peak count of 141 Hawaiian duck x mallard hybrids was recorded on the Kiʻi Unit of the James Campbell NWR (USFWS unpub). Populations on Maui are also suspected to largely consist of Hawaiian duck x mallard hybrids. Estimated Hawaiian duck hybrid counts on these islands are 300 and 50 birds, respectively (Engilis et al. 2002; USFWS 2005a). The current wild population of pure Hawaiian ducks is estimated at approximately 2,200 birds. Approximately 200 pure individuals occur on the Island of Hawaiʻi and the remainder resides on Kauaʻi. Because of similarities between the species, it can be difficult to distinguish between pure Hawaiian ducks, feral hen mallards, and hybrids during field studies.

Habitat types utilized by the Hawaiian duck include natural and man-made lowland wetlands, flooded grasslands, river valleys, mountain streams, montane pools, forest swamplands, aquaculture ponds, and agricultural areas (Engilis et al. 2002; Hawaiʻi Audubon Society 2005; USFWS 2005a). The James Campbell NWR provides suitable habitat for foraging, resting, pair formation, and breeding (Engilis et al. 2002). No suitable habitat for Hawaiian duck occurs on the Honuaʻula Property.

Breeding occurs year-round, although the majority of nesting occurs from March through June. The peak breeding season on Kauaʻi occurs between December and May and the peak on Hawaiʻi occurs from April to June (Uyehara et al. 2008). Nests are placed in dense shoreline vegetation of small ponds, streams, ditches and reservoirs (Engilis et al. 2002). Types of vegetation associated with nesting sites of Hawaiian duck include grasses, rhizomatous ferns and shrubs (Engilis et al. 2002). The diet of Hawaiian ducks consists of aquatic invertebrates, aquatic plants, seeds, grains, green algae, aquatic mollusks, crustaceans and tadpoles (Engilis et al. 2002; USFWS 2005a).

Current Threats to the Hawaiian Duck. Loss of habitat and hybridization with mallards are the largest threats to the Hawaiian duck. In addition, Hawaiian ducks are predated by mongoose, feral

cats, feral dogs, and possibly rats (Engilis et al. 2002). Black-crowned night herons, largemouth bass (*Micropterus salmoides*), and bullfrogs have also been observed to take ducklings (Engilis et al. 2002). Avian diseases are another threat to Hawaiian ducks, with outbreaks of avian botulism (*Clostridium botulinum*) occurring annually throughout the state. In 1983, cases of adult and duckling mortality on Oʻahu were attributed to aspergillosis and salmonella (Engilis et al. 2002).

Occurrence of the Hawaiian Duck on Maui and at the Property. The Maui population of Hawaiian duck was estimated in 2004 at less than 20 birds, which occur primarily at Kanahā pond. This small breeding population is a result of a release of fewer than 12 captive individuals, which was conducted by the State of Hawaiʻi in 1989. Hybridization with feral mallards does occur on Maui and hybrids are likely to outnumber Hawaiian ducks (USWFS 2005a). No Hawaiian ducks were observed at the Property during any of the surveys.

3.8.4 Covered Species

3.8.4.1 Blackburn's Sphinx Moth

Population, Biology, and Distribution of Blackburn's Sphinx Moth. The Blackburn's sphinx moth is one of Hawaiʻi's largest insects with a wingspan of up to 12 cm. It is closely related to the North American tomato hornworm (*Manduca quinquemaculata*), with which it has been confused in the past. The two species differ substantially in biology and are geographically distinct. Riotte (1986) demonstrated that Blackburn's sphinx moth is a distinct species, native to the Hawaiian Islands, and these findings are accepted as valid to date. Relatively little research has been conducted on this species, thus there is a paucity of information on its biology, habitat associations, and population status. The Blackburn's sphinx moth is the first listed insect species in Hawaiʻi.

The Blackburn's sphinx moth is currently found in topographically diverse landscapes and in areas with low to very high levels of non-native vegetation. The primary constituent elements required by Blackburn's sphinx moth larvae for foraging, sheltering, and maturation are the two documented host plant species in the genus *Nothocestrum* (*N. latifolium* and *N. brevifolium*), both of which themselves are proposed or listed endangered species. At lower elevations the larvae are found most often on the non-native tree tobacco (*Nicotiana glauca*), but has also been found on commercial tobacco (*Nicotiana tobaccum*), eggplant (*Solanum melongena*), tomato (*Solanum lycopersicum* var. *cerasiforme*) (USFWS 2005), and the indigenous popolo (*Solanum americanum*). Primary constituent elements required by Blackburn's sphinx moth adults for foraging, sheltering, dispersal, breeding, and egg production that occur on the Property are native nectar-supplying plants mostly with a long, tubular calyx. Adult moths have been observed feeding on the native morning glory (*Ipomoea indica*) and halapepe (*Pleomele auwahiensis*), but they are expected to feed on a range of potential host plants that possess characteristics of adaptation to moth pollination, including a tubular calyx, light coloration, nocturnal anthesis (opening at night), or strong fragrance. Possible native adult host plants include maiapilo (*Capparis sandwichiana*), ʻilieʻe (*Plumbago zeylanica*), but non-native plants, including tree tobacco, may be used by adult moths for feeding (Rubinoff, UH, pers. comm.).

Minimum development time from egg to adult is reported as 56 days (Williams 1947), but VanGelder and Conant (1998) reported an average development time of 75.9 days based on data collected on moths reared in captivity. Information on adult longevity is not available, but sphingid moths generally have a longer lifespan than most moths, thanks to their ability to feed from a variety of sources, rather than relying on stored fat reserves. Captive moths in a study by VanGelder and Conant (1998) did not live longer than 12 days as an adult. They also did not observe adult moths feeding or attempting to feed on morning glory flowers, or artificial flowers. Despite this apparent lack of feeding these moths successfully reproduced. Larvae descend from their host plant or tree and search for suitable soil before pupating. They may remain dormant in the soil for up to one year (Rubinoff, UH, pers. comm.) as is common with congeneric species.

No estimates exist for Blackburn's sphinx moth population numbers, but the species is believed to have been in decline over the past 100 years (USFWS 2005). After an effort led by Bishop Museum staff to find the species in the late 1970s, it was considered extinct (Gagné and Howarth 1985),

until 1984, when a population was discovered on Maui (Riotte 1986). The Blackburn's sphinx moth was once known from all of the Hawaiian Islands, but currently is restricted to Maui, Kahoʻolawe, and Hawaiʻi. The decline and disappearance from several islands has been attributed to habitat loss and fragmentation from urban and agricultural development, increased wildfire frequency, invasion by non-native invasive weeds, impacts from ungulate grazing, and direct impacts on the moth from non-native parasitoid flies and wasps, and insect predators.

Current Threats to Blackburn's Sphinx Moth. The Blackburn's sphinx moth recovery plan (USFWS 2005) cites a number of factors contributing to the species' continued decline. However, the magnitude and importance to limiting recovery of the species is unknown at this time. Dry and mesic forests are believed to play an important role in the moth's seasonal foraging and sheltering needs (USFWS 2005), and based on this assumption; the moth's range has declined approximately 82 percent since human arrival in the islands. The primary constituent elements required by Blackburn's sphinx moth larvae for foraging, sheltering, maturation, and dispersal include two documented host plant species in the genus *Nothocestrum* (*N. latifolium* and *N. brevifolium*) which are presently listed as endangered. Habitat loss and fragmentation exacerbates the impact of decreased nectar availability during drought, causing further threat to future viability of population (USFWS 2005).

Alien arthropods are believed to be a major threat to the Blackburn's sphinx moth through predation, parasitism, and direct competition. The main suspected predators include a number of ant (Formicidae) species which are known to impact other native arthropods, or are known predators of Lepidoptera elsewhere in their introduced range. Ants are not believed to be a native component of native Hawaiian fauna (Wilson 1996), and presently at least fifty species of invasive ants have become established in Hawaiʻi (Plentovich et al. 2010). Many ants are generalists, and can be particular destructive to native insular biota due to their high densities, recruitment behavior, and aggressiveness (Reimer 1993). The Blackburn's sphinx moth recovery plan (USFWS 2005) lists the following ant species as presenting a threat to the moth: *Pheidole megacephala*, *Iridomyrmex humilis, Anoplolepis gracilipes, Solenopsis geminata, S. papuana, and Ochetellus glaber*.

Parasites introduced either intentionally or accidentally, are believed to be a major factor limiting recruitment of the Blackburn's sphinx moth. Because of the relative rarity of the moth, the impact of parasitoids has not been quantified, but introduced parasitic braconid and ichneumonid wasps and tachinid flies have an abundance of hosts, and are considered a potentially major threat (USFWS 2005). A number of species of parasitic wasps in the Trichogrammatidae are established in Hawaiʻi, including and *Trichogramma* species were found to have parasitized 70% of eggs in a study by Williams (1947), and 8.8% of eggs in VanGelder and Conant's (1998) study. Although the impact of these wasps is most likely density dependent, the abundance of alternative hosts may enable extinction of the Blackburn's sphinx moth as part of the broader host base (Nafus 1993). Two parasitic tachinid flies (*Chaetogaedia* monticola, and *Lespesia archippivora*) have been purposefully introduced to control army worms. Both species are known to parasitize a variety of lepidopteran species, including sphinx moths, and both are known to occur on Maui and Hawaiʻi (Nishida 1997).

Occurrence of Blackburn's Sphinx Moth on Maui and at the Property. Neither *N. latifolium* nor *N. brevifolium*, which are considered to be a primary constituent element (PCE) required by Blackburn's sphinx moth larvae for foraging, sheltering, maturation, and dispersal, occurs on the Property or would likely survive if propagated on the Property, due to constraints related to rainfall and elevation.

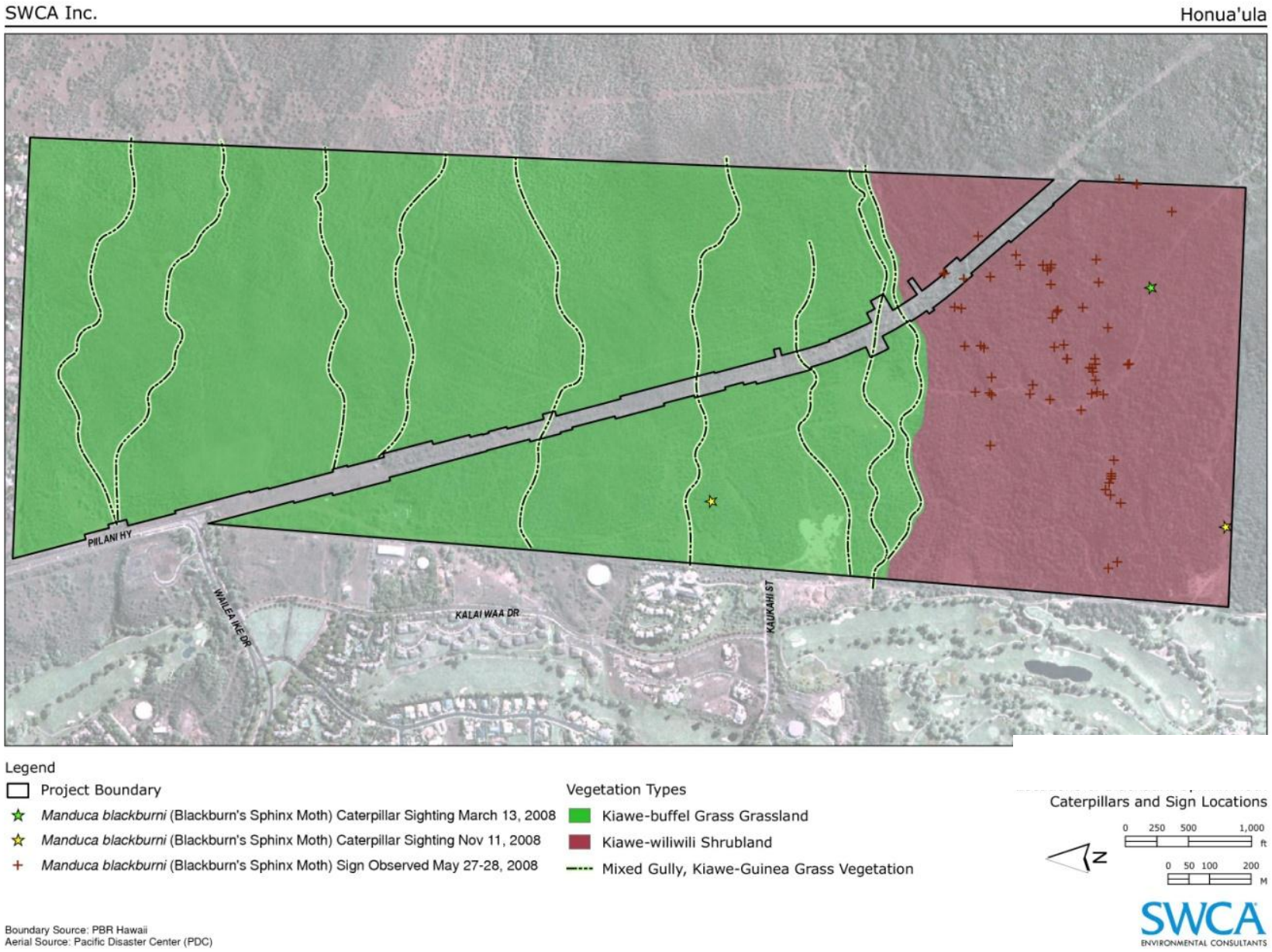
Primary constituent elements required by Blackburn's sphinx moth adults for foraging, sheltering, dispersal, breeding, and egg production that occur on the Property are native nectar-supplying plants, including, morning glory (*Ipomoea* spp.), maiapilo (*Capparis sandwichiana*), and ʻilieʻe (*Plumbago zeylanica*). Another adult host plant may include halapepe (*Pleomele auwahiensis*) (USFWS 2005); however, this species is not found on the Property. The habitats that support these plants, i.e., dry and mesic habitats between the elevations of sea level and 1,525 m (5,000 ft) that receive between 25 and 250 cm (10 and 100 in) of annual precipitation, are also considered important elements in the recovery of the species by the USFWS (68 FR 111 34709-34766).

Over 60 separate occurrences of moth sign (cut stems, chewed leaves, and frass) were found on tree tobacco within the kiawe-wiliwili shrubland habitat by Dr. David Preston of the Bishop Museum during surveys conducted in 2008 (Figure 3.5). However, Blackburn's sphinx moth densities were much lower than those of the non-native White-lined sphinx moth (*Hyles lineata*) and the non-native Oleander hawk moth (*Daphnis nerii*) found at Kanaio and Kahului by Van Gelder and Conant (1998).

VanGelder and Conant (1998) report Oleander hawk moth larvae on tree tobacco at Kanahā, Kahului, and White-lined sphinx moth larvae on tree tobacco at KNGTA lands. Vangelder and Conant (1998) report that Oleander hawk moth feeding damage 'appeared different' from that of Blackburn's sphinx moth, but they did not specify how to distinguish the two. Despite this reported difference in appearance, the report raises to question the technique of using leaf damage as an indication of Blackburn's sphinx moth activity, unless leaf damage can be distinguished. It also questions the identity of eggs found in areas where multiple species occur.

SWCA has photo documented Oleander hawk moth larvae on tree tobacco on Maui, Kim and Forest Starr (pers. comm.) have photo-documented *Agrius cingulata* feeding on tree tobacco, and Heather Eijzenga (PCSU, pers. comm.) has documented White-lined sphinx moth feeding on tree tobacco on ʻAleʻale off Kahoʻolawe. These non-native species are polyphagous. There are nine genera and twelve species of sphingid moths in Hawaiʻi. In addition, a multitude of additional organisms, including other lepidopterans, cause leaf and stem damage on tree tobacco, and using leaf and stem damage alone is an inaccurate assessment of Blackburn's sphinx moth activity. Dr. Daniel Rubinoff, Hawaiʻi's leading lepidopterist, insists that cut leaf stems and leaves cannot be used as a definitive sign of Blackburn's sphinx moth presence (Rubinoff, CTAHR UH, personal communication, Jan 26 and Apr 26, 2011). It should therefore not be presumed that the large number of 'signs' found at Honuaʻula are all attributable to Blackburn's sphinx moth. Three Blackburn's sphinx moth caterpillars were observed on tree tobacco over the period of study. SWCA has never observed any adult Blackburn's sphinx moth on the Property.

Figure 3.5: Locations of Blackburn's sphinx moth caterpillars and sign



3.8.4.2 Nēnē

Population, Biology, and Distribution of Nēnē. The nēnē is a medium-sized goose with black head and nape contrasting a yellow-buff check and neck. Overall length is 63 to 69 cm (25-26 in) (HAS 2005). The nēnē is adapted to a terrestrial and largely non-migratory lifestyle in the Hawaiian Islands with negligible dependence on freshwater habitat. Compared to the related Canada goose (*Branta canadensis*), nēnē wings are reduced by about 16% in size and their flight capability is comparatively weak. Nonetheless, the nēnē is capable of both inter-island and high altitude flight (Miller 1937; Banko et al. 1999).

After nearly becoming extinct in the 1940s and 1950s, the nēnē population slowly has been rebuilt through captive-breeding programs. Wild populations of nēnē occur on Hawaiʻi, Maui, and Kauaʻi. The USFWS estimated that in the early part of the last decade, the nēnē population numbered 1,300 individuals (USFWS 2004a). The primary release site on Maui is located at Haleakalā National Park on East Maui where 511 nēnē were released between 1962 and 2003.

Since 1995, the majority of Maui releases have been from a release pen in the Hanaʻula region of West Maui in an effort to establish a second population on Maui on this part of the island (F. Duvall, Maui DOFAW, pers. comm.). Since 1994, 104 nēnē have been released at Hanaʻula, and 18 have been released at Haleakalā (USFWS 2004a). An effort to move approximately 300 nēnē off areas adjacent to airport runways on Kauai is underway, and as of May 2012 approximately 30 birds have been moved into pens at Haleakala Ranch.

The nēnē has an extended breeding season with eggs reported from all months except May, June and July, although the majority of birds in the wild nest during the rainy (winter) season between October and March (Banko et al. 1999, Kear and Berger 1980). Nēnē nest on the ground in a shallow scrape in the dense shade of a shrub or other vegetation. A clutch typically contains three to five eggs and incubation lasts for 29 to 31 days. The female incubates the eggs, with the male standing guard nearby, often from an elevated location. Once hatched, the young remain in the nest for one to two days (Banko et al. 1999). Fledging of captive birds occurs at 10 to 12 weeks, but may occur later in the wild. During molt, adults are flightless for a period of 4 to 6 weeks. Molt occurs after hatching of eggs, such that the adults generally attain their flight feathers at about the same time as their offspring. When flightless, goslings and adults are extremely vulnerable to predators such as dogs, cats, and mongoose. From June to September, family groups join others in post-breeding aggregations (flocks), often far from nesting areas.

Nēnē occupy various habitat types ranging from beach strand, shrubland and grassland to lava rock, at elevations ranging from coastal lowlands to alpine areas (Banko 1988; Banko et al. 1999). The geese eat plant material, and the composition of their diet depends largely on the vegetative composition of their surrounding habitats. They appear to be opportunistic in their choice of food plants as long as the plants meet their nutritional demands (Banko et al. 1999; Woog and Black 2001).

Current Threats to Nēnē. Current threats to nēnē include predation by non-native mammals, exposure in high-elevation habitats, insufficient nutritional resources for both breeding females and goslings, a lack of lowland habitat, human-caused disturbance and mortality (e.g., road mortality, disturbance by hikers), behavioral problems related to captive propagation, and inbreeding depression (USFWS, unpubl., USFWS 2004a). Predators of nēnē eggs and goslings include dogs, cats, rats and mongoose. Dogs and mongoose are also responsible for most of the known cases of adult predation (USFWS 2004a). Nēnē have also been negatively impacted by human recreational activities (e.g., hikers and hunters), and a number have been struck by vehicles. Nēnē may be attracted to golf courses, especially when water features are present, and become exposed to higher chances of interactions with humans. They may become subject to accidental strikes by golf balls, harassment, or even be intentionally killed. Adult birds, but especially chicks, are vulnerable to being struck by golf carts, trucks, and mowers (Medeiros, DOFAW; Swindle, USFWS pers. communication). In recent years, at least six nēnē have been inadvertently struck and killed by golf balls, and at least one has been intentionally killed on a golf course on Maui (USFWS 2004a, Medeiros, DOFAW pers. comm.).

Starvation and dehydration can be major factors in gosling mortality. Approximately 81.5% of gosling mortality in Haleakalā National Park during the 1994 to 1995 breeding season was due to starvation and dehydration (USFWS 2004a). From 2005 – 2007, between 30 to 50% of the goslings at the Hakalau Forest Unit died due to drought and/or exposure (USFWS, unpubl. report). A lack of adequate food and water supplies also seems to be a limiting factor in Hawaiʻi Volcanoes National Park (USFWS 2004a).

For nēnē populations to survive they must be provided with generally predator-free breeding areas and sufficient food resources; human-caused disturbance and mortality must be minimized; and, genetic and behavioral diversity maximized. At the same time, it is recognized that nēnē are highly adaptable, successfully utilizing a gradient of habitats ranging from highly altered to completely natural, which bodes well for recovery of the species.

Occurrence of Nēnē on Maui and at the Property. The first captive nēnē to be reintroduced to Maui were 30 birds that were bred by the Wildfowl and Wetlands Trust in Slimbridge, England, and five birds from the Pohakuloa propagation project on Hawaiʻi. These birds were released in Haleakalā Crater at Haleakalā National Park on July 26, 1962 (Walker 1969). Besides Haleakalā, nēnē have been reported from Kahikinui, Kīhei, Kula, Lahaina, Olinda, Wailuku, and West Maui areas. The Maui population of nēnē in 2002 was estimated at 336 (USFWS 2004a). Nēnē were not observed during any of the surveys on the Property.

4 BIOLOGICAL GOALS AND OBJECTIVES

The final addendum to the *Handbook for Habitat Conservation Planning and Incidental Take Permitting Process* (USFWS 2000) is a five-point policy guidance for the HCP process. The addendum outlines the importance of defining biological goals. These broad, guiding principles clarify the purpose and direction of an HCP's operating conservation program. Biological objectives are also integral to the HCP process to achieve the different components of the biological goals. The objectives are more measurable than the goals and may include: species or habitat indicator, location, action, quantity/state, and timeframe needed to meet the objective (USFWS 2000).

Honuaʻula Partners, LLC has met with local representatives of the USFWS and Hawaiʻi DLNR to discuss potential adverse impacts to the two Covered Species, measures to practicably avoid and minimize the potential for adverse impacts to all listed species, and biological goals and objectives. Where the potential for impacts is unavoidable, this HCP provides means to minimize and mitigate any adverse impacts to the listed species that may occur, and to provide a net conservation benefit.

Based on on-going surveys conducted in the project area, as well as records of species known to exist at adjacent areas, the proposed project is expected to directly or indirectly impact Blackburn's sphinx moth and nēnē, may attract Hawaiian stilt, Hawaiian coot, Hawaiian duck, Newell's shearwater, and Hawaiian petrel, and impacts to Hawaiian hoary bat and ʻāwikiwiki can be avoided.

Specific biological goals of this HCP are to:

1. Avoid impacts of construction activities on the Hawaiian hoary bat, ʻāwikiwiki, Newell's shearwater, Hawaiian petrel, and Blackburn's sphinx moth.
2. Avoid impacts of post-construction operations on Hawaiian stilt, Hawaiian coot, Hawaiian duck, Newell's shearwater, Hawaiian petrel, and ʻāwikiwiki.
3. Avoid and minimize, to the maximum extent practicable, impacts of post-construction operations on nēnē and Blackburn's sphinx moth.
4. Provide a net conservation benefit for the recovery of the Blackburn's sphinx moth and nēnē, pursuant to Chapter 195D, HRS.
5. Maintain the present population of ʻāwikiwiki on the property, and as much of the present population of nehe as practicable.

Specific biological objectives accompanying these biological goals are:

1.a. Develop and implement BMPs to prevent harm to Covered Species.
1.b. Provide endangered species awareness training to all construction personnel.
1.c. Deploy construction monitors to prevent harm to Covered Species.

2.a. Develop and implement BMPs for operations to prevent harm to Covered Species.
2.b. Provide endangered species awareness training to all employees.
2.c. Develop and implement a program to educate golfers about endangered species present on the golf course, and measures to avoid harm to Covered Species.
2.d. Develop and implement a program to avoid or minimize light-induced attraction of seabirds to the project site through selection and installation of appropriate lighting fixtures.

3.a. Adhere to goals of existing recovery plans for the species, considering the most recent updated information and goals.
3.b. Implement specific measures to manage and protect off-site habitat equivalent to the habitat destroyed by construction activities.

4.a. Develop and implement construction and operations BMPs to prevent harm to listed species.
4.b. Protect existing native plants on site from development and post-construction activities.

5 ALTERNATIVES

5.1 No-Action ("No Build") Alternative

The "no-action" alternative would occur if the USFWS and DLNR fail to issue an ITP/ITL for the project. This would result in a "no build" alternative that would mean the Honuaʻula community would not be constructed, and the Property would remain vacant. There would be no master-planned community embracing "smart growth" principles, such as diverse residential opportunities, village mixed uses, onsite recreational amenities, and integrated bicycle and pedestrian networks. Honuaʻula Partners, LLC is a business entity created for this sole purpose; thus, a "no build" alternative is contrary to the Applicant's fundamental purpose and objective. Moreover, the vision for Project District 9 would not be realized, and decisions regarding the use of the Property for residential, recreational, and commercial uses previously made by the State LUC, the Maui Planning Commission, and the Maui County Council would not be implemented. In addition, under the no-build alternative, many of the conditions of zoning under County of Maui Ordinance No. 3554 that benefit the entire region would not be implemented. Likewise, the no-build alternative would deprive the State, County and general public of the significant economic benefits associated with Honuaʻula, and the range of mitigation measures proposed in this HCP for the protection and recovery of Covered Species would not be implemented. Lastly, the projected increasing demand for housing for a range of consumer groups in the Kīhei-Mākena region would remain unmet.

5.2 Alternative Preserve Layout

The initially evaluated site layout included a 22 acre native plant preserve along with 26 acres of native plant conservation area. During the evaluation process it was determined that much of the native plant conservation area was too fragmented and small or narrow to effectively protect the natural resources contained within. Effective preservation of 22 acres of onsite Blackburn's sphinx moth habitat was deemed to be difficult to manage and ineffective. For the native plants, the 22-acre area was not located or sized adequately to address an appropriate cross section of plants or density and was therefore enlarged to address this concern as well. In comparing the original 22 acre alternative with the proposed 40 acre proposal the owner has achieved a doubling of the preserve area without impacting the economic viability of the project.

Another alternative preserve layout was evaluated, but later deemed unacceptable. In this alternative, a master planned community would be constructed at the same location as the Proposed Action but with significant modifications to the size and location of the Single-family, Multi-family, Recreation and Open Space/Utilities Sub-Districts. The Native Plant Preservation Area within the Open Space Sub-District would be located on approximately 80 acres overlapping the preservation area described in the Proposed Action. This increase in acreage would shift a significant portion of both the single-family and multi-family housing density and acreage into the northern portion of the project, thereby increasing densities and modifying land use designations from single-family to multi-family in order to achieve the desired densities within the project. This shift in density and use would directly conflict with the conditions of approval and provisions contained within Maui County Code Section 19.90A (Project District 9 Zoning Ordinance) as well as off-site infrastructure improvements already designed to accommodate the location and densities approved within the conditions of approval and project district ordinance. In addition to causing the project to violate its project district zoning ordinance and its conditions of approval, this alternative would cause significant adverse economic impacts that would render the project infeasible.

6 POTENTIAL IMPACTS

6.1 Estimating Project-Related Impacts

6.1.1 Blackburn's Sphinx Moth

Currently available scientific information regarding the population biology (e.g., distribution and abundance, density, population genetics) of Blackburn's sphinx moth on Maui is insufficient for use in calculating potential take at Honuaʻula. Furthermore, abundance of both host plants and individual moths varies on a temporal scale, complicating quantification of potential take. Direct take of adult moths, larvae, eggs, and pupae will be avoided following USFWS guidelines (Appendix 11), and requested take will be limited to permanent habitat loss for the Blackburn's sphinx moth. Therefore, in accordance with the Habitat Conservation Plan Handbook (Chapter 3, Sections B.2.b. and C.1), we employ a habitat-based approach to quantify take and to design on-site and off-site mitigation measures.

Vegetation across the 670 acre Property is not homogenous and is well delineated by three primary vegetation types: kiawe-buffelgrass (*Prosopis pallida-Cenchrus ciliaris*) grassland, intermittent drainage gulches and a kiawe-wiliwili shrubland (SWCA 2009a). The kiawe-wiliwili shrubland is delineated by the younger Hana Volcanic flow located in the southern 170 acre portion of the Property (Figures 3.3 and 6.1). Most plants believed to be native host species for adult Blackburn's sphinx moths including maiapilo (*Capparis sandwichiana*), morning glory (*Ipomoea spp.*), ʻiliʻeʻe (*Plumbago zeylanica*) are confined to this southernmost portion of the Property (Figure 3.4, table 6-1), and all evidence of Blackburn's sphinx moth larval presence and all but one larvae sightings occurred in this southern portion of the Property. Thus, we do not expect any take of individual moths or moth habitat to occur in the northern 497 acre portion of the property, which is characterized by kiawe-buffelgrass grassland.

To minimize project impacts to the Blackburn's sphinx moth and as part of the on-site mitigation (see section 7.3.1 for details) a perpetual conservation easement of 40 acres for a Native Plant Preservation Area will be preserved within the kiawe-wiliwili shrubland. No take of Blackburn's sphinx moth or moth habitat is expected to occur in this area. Therefore, we estimate the total take of Blackburn's sphinx moth habitat resulting from the construction of Honuaʻula to total 130 acres.

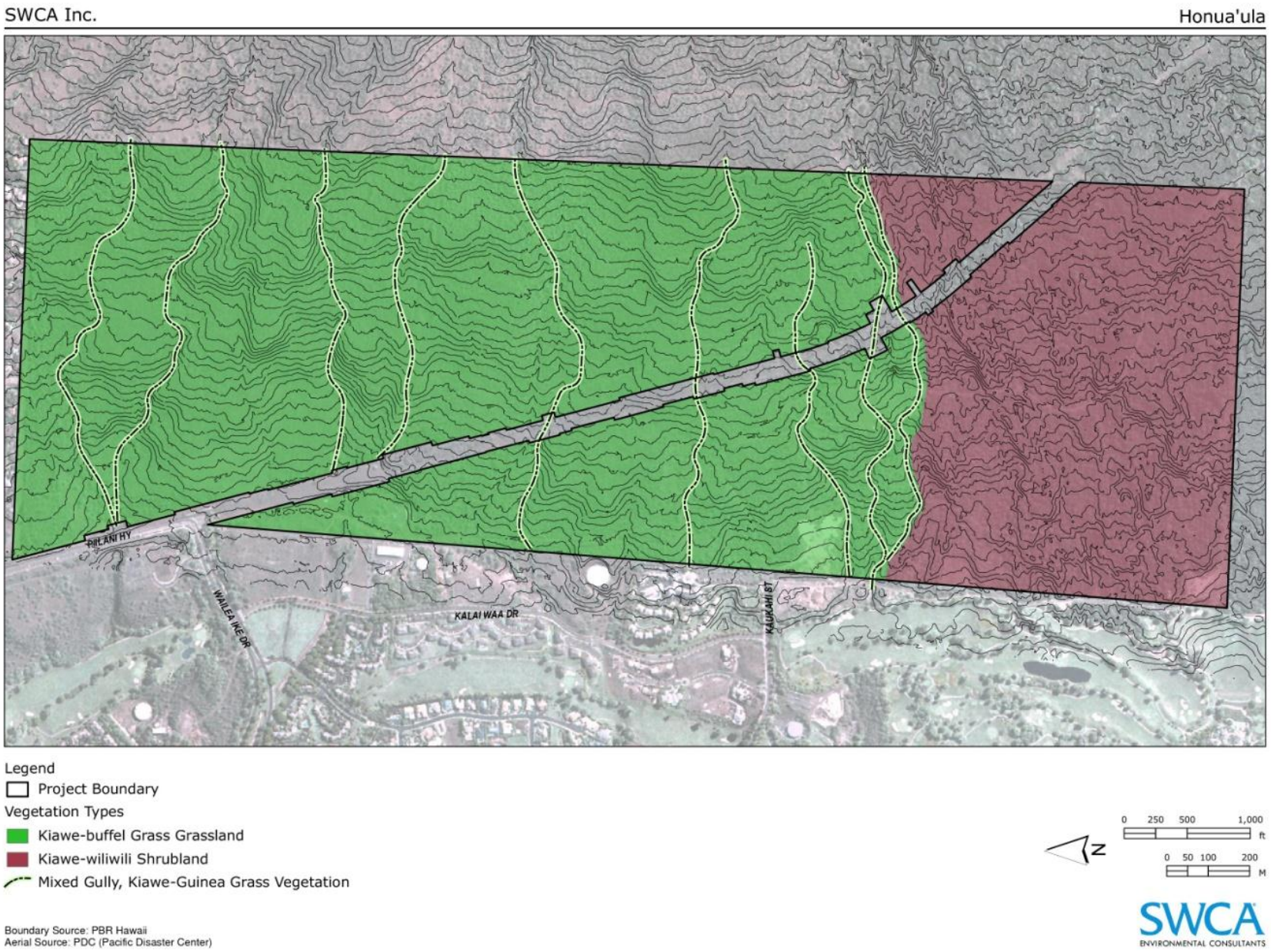
Tree tobacco and pōpolo (*Solanum americanum*) are the only confirmed larval host plants at the site and a very low number of scattered individual plants may be found in the northern portion of the Property. If any are found in the gulches or any other portion of the Property in which the existing vegetation is left intact, no impacts to Blackburn's sphinx moth larvae are anticipated. Any concerns for pesticide overspray in to areas with natural vegetation are addressed in the FEIS.

Although avoidance and minimization practices will be put into place as described in section 7.1.1.13, direct take of individual Blackburn's sphinx moth at the property may still occur during construction. In addition, because host plants will be maintained within the property, mainly the Native Plant Preservation Area, moths utilizing the property may be impacted by light attraction at the site post-construction. Based on USFWS recommendation to include direct take of Blackburn's sphinx moth, Honuaʻula Partners LLC requests the direct take of all moth larvae still occupying the soil within the project footprint during construction, despite avoidance measure implementation, in addition to up to one individual moth per year for the life of the permit.

Table 6-1: A comparison of the number of native plants and seedlings observed within the entire Honuaʻula Property and the remnant mixed kiawe-wiliwili shrubland in the southern portion of the Property. Prop = entire Honuaʻula Property, KW = kiawe-wiliwili shrubland, NPPA = Native Plant Preservation Area. Adapted from SWCA (2009a).

Species (Hawaiian name)	Number of Points			Number of Seedlings			Number of Adults			Total Numbers Observed		
	KW	Prop	NPPA	KW	Prop	NPPA	KW	Prop	NPPA	KW	Prop	NPPA
Argemone glauca (pua kala)	26	26	4	247	247	119	165	165	58	412	412	177
Canavalia pubescens ('āwikiwiki)	5	5	5	0	0	0	5	5	5	5	5	5
Capparis sandwichiana (maiapilo)	311	312	91	14	14	0	548	549	168	562	563	168
Dodonea viscosa (ʻaʻaliʻi)	7	7	1	0	0	0	16	16	1	16	16	1
Doryopteris decipiens (ʻiwaʻiwa)	2	14	1	0	2	0	7	52	6	7	54	6
Erythrina sandwicensis (wiliwili)	546	569	127	334	341	64	2105	2137	554	2439	2478	618
Heteropogon contortus (pili)	0	66	0	0	384	0	0	1109	0	0	1493	0
Ipomoea tuboides (ipomea)	5	5	0	0	0	0	5	5	0	5	5	0
Lipochaeta rockii (nehe)	24	24	16	56	56	48	45	45	33	101	101	81
Myoporum sandwicense (naio)	17	17	8	0	0	0	21	21	11	21	21	11
Senna gaudichaudii (kolomona)	28	32	4	1	5	0	36	38	4	37	43	4
Sicyos hispidus (ʻānunu)	48	49	13	5	5	0	107	108	41	112	113	41
Sicyos pachycarpus (ʻānunu)	101	102	13	313	313	199	289	290	43	602	603	242

Figure 6.1: Vegetation types within the property



6.1.2 Nēnē Direct Take

Nēnē are currently not found at or near the Property (SWCA 2009b) and the nearest populations occur at Haleakalā National Park, and West Maui (USFWS 2005). There have been nēnē sightings in Kīhei, Maʻalaea, and ʻUlupalakua, and the Property's location in between these sites puts it within a hypothetical flight path between these sites. Construction activities are not expected to attract nēnē to the Property, and therefore no direct take is anticipated for this species during the construction phase.

The creation of golf greens and lawns on the Property may conceivably attract nēnē. A variety of human activities may lead to direct take of nēnē, including disturbance caused by hikers, hunters, and other outdoor recreational activities, and harm caused by vehicles, and golf balls (USFWS 2005, Swindle, USFWS pers. comm.). There is anecdotal information about incidents involving injury to or death of nēnē on golf courses, but there is no quantitative data on which to base a take estimate. In addition, incidents resulting in disturbance or take of nēnē are not always documented or reported, and cause of mortality is often undetermined (Medeiros, DOFAW per. comm.). Golf balls struck nēnē on at least six occasions between 1992 and 1994 at Volcano Golf Course and Country Club, Hawaiʻi. Five birds died as a result and a sixth one died as a result of predation as it lingered overnight with its stricken mate (Banko et al. 1999). This golf course is located within close proximity of a core population of nēnē at Hawaiʻi Volcanoes National Park. In addition there is one report of nēnē intentionally killed by golfers on Maui in 1997.

Agency biologists estimate that approximately 1-3 incidents occur per year across the 50 golf courses on the islands of Kauaʻi, Maui, and Hawaiʻi (Swindle USFWS, Creps DOFAW, Polhemus formerly DOFAW, pers. comm.), but Maui nēnē biologist for DOFAW on Maui, John Medeiros, estimates that the number of incidents resulting in take on the 14 golf courses on Maui averages between 1-3 per year, fluctuating greatly between years. Currently, there are no reports of nēnē in the Mākena-Wailea area (Medeiros, DOFAW pers. comm.), indicating a low likelihood of nēnē becoming attracted to or even established on the Property. However, Haleakalā Ranch, in cooperation with USWFS and DOFAW, is constructing a release pen southeast of Manawainui gulch at 2,625 feet elevation in the Waiopae area, at which nēnē will be released in the near future (Haleakalā Ranch, USFWS, DLNR, 2009). This is expected to increase the nēnē population on Maui and locally, and will bring nēnē closer to the relative vicinity of the Property, and increase the likelihood of nēnē sightings at or in the vicinity of the Property. How much this likelihood will increase is unknown. Although in general females remain near their natal sites, while males disperse, reasons for fluctuations in dispersal are relatively unstudied.

In addition, released females are less philopatric than wild ones (Woog 2000). Nēnē are most vulnerable to take during nesting activities. Eggs and chicks can be struck by trucks, golf carts, and mowers, or nest failure can occur as a result of predation. Adults are more aggressive when breeding, which leads to increased interaction with humans around the breeding site. Measures will be implemented to avoid nesting on the Property (see Section 7.1.11), but if the nēnē population increases in the vicinity of the Property, nesting may not be entirely avoidable in the future. Nēnē are generalist feeders, and are known to feed on a variety of native and non-native berries, sedges and grasses, and are attracted to mowed turf. They will nest under a variety of shrubs, including, but not limited to the native pūkiawe (*Leptecophylla tameiameiae*), aʻaliʻi (*Dodonaea viscosa*), ʻōhelo (*Vaccinium reticulatum*), and non-native christmasberry (*Schinus terebinthifolius*), lantana (*Lantana camara*), and ironwood (*Casuarina equisetifolia*) (Banko et al. 1999). Currently, nēnē nest on 2-3 of Maui's 14 golf courses every year (Medeiros, DOFAW pers. comm.).

For direct take estimate, based on information and assumptions presented above, we estimate an incident rate of 0.25 nēnē/year/golf course, or 1 nēnē every 4 years. The Property is not currently located in close proximity to existing nēnē habitat, the golf course will not contain water features, and extensive golf course operation minimization and avoidance measures will be implemented. Nevertheless, we assume an incidental take risk of 0.25 nēnē take occurrences per year.

6.1.3 Nēnē Indirect Take

Honuaʻula will implement management strategies aimed at preventing the creation of an attractive nuisance, in particular conditions favorable for nēnē nesting. Therefore, nēnē are most likely to visit the golf greens at the Property during non-breeding periods (May through July) or at the end of their breeding period when the adults and young may travel as family groups. Nēnē are highly territorial during the breeding season (Banko et al. 1999) and males are likely to be defending nesting territories while the females are incubating. Upon hatching, both parents attend to heavily dependent young; adult nēnē also molt while in the latter part of their breeding period and are therefore flightless for four to six weeks (USFWS 2004a). These adults attain their flight feathers at about the same time as their goslings (USFWS 2004a). Consequently, such birds are more likely to visit the property only when goslings have already fledged.

Indirect take to account for loss of dependent young will be assessed for adult nēnē only when mortality occurs during the breeding season (August to April). Adults found during the months of October through March will be assumed to have had a 60% chance of having been actively breeding because 60% of the population has been recorded to breed in any given year (Banko et al. 1999). Adult nēnē mortality that occurs outside the peak breeding season (April, August and September) will be assumed to have had a 25% chance of breeding. Male and female nēnē care for their young fairly equally, so indirect take is assessed equally to the direct take of any male or female adult nēnē found during the breeding season. Because breeding nēnē are not expected to visit the Property prior to the fledging of their young, we base the number of young possibly affected by loss of an adult on the average number of fledglings produced per pair (studies indicate that average number of fledglings produced annually per pair of nēnē is 0.3 (Hu 1998)).

Based on these assumptions, as indicated in Table 6.2 below, the amount of indirect take assessed for each direct take of an adult nēnē during the months of October through March is 0.09. Amount of indirect take assessed for each direct take of an adult bird during the remainder of the breeding season is 0.04.

Table 6-2: Calculation of indirect take of nēnē.

Nēnē	Season	No. fledglings per pair (A)	Likelihood of breeding (B)	Parental contribution (C)	Indirect (A*B*C)
Adult, any gender	Oct-Mar	0.3	0.60	0.5	0.09
Adult, any gender	April, Aug and Sep	0.3	0.25	0.5	0.04
Adult, any gender	May–July	--	0.00	--	0.00
Immature	All year	--	0.00	--	0.00

6.1.4 Estimated Total Take for Nēnē

Direct take estimates based on current and future projections of nēnē mortality on golf courses is low. In addition, the actual number of incidents per year fluctuates significantly (Medeiros, DOFAW pers. comm.). To account for the stochasticity of take over time, where take in any given year take may be higher or lower than the expected long-term average, this HCP includes a 30-year project term take limit, as well as a one-year take limit (e.g., take could be authorized as three individuals in any given year but not more than five individuals total for the project duration). The total project-life take limit is a better reflection of the long-term amount of take expected, while the one-year short term take limit reflects the maximum expected take for any given year.

Nēnē are not expected to be attracted to the golf greens every year, particularly in their current population status and distribution. However, the population of nēnē on Maui is expected to expand, which may increase the likelihood of the species occurring at Honua'ula. Therefore incidental take of nēnē is estimated over 15 years, rather than the full 30-year project life span.

The estimated direct take incidental to golf course operations is 3.75 birds. Indirect take associated with these nēnē is 0.3 (0.09 per take), thus the total estimated take is 4.05 nēnē. Requested and expected take is summarized below in table 6-3.

Table 6-3: Expected take, and requested take: 1-year limit, and 15-year project life limit.

Tier		***Direct***	***Indirect***	***Total***
Expected take	Annual average	0.25	0.02	0.27
	Project life	3.75	0.3	4.05
Requested take	1-year limit	1 (0.25)	1 (0.02)	2 (0.27)
	Project life limit	4	1	5

The current population of nēnē statewide is estimated at 1,300 individuals with 315 birds occurring on Maui (DOFAW unpubl. data 2003). The rates of take estimated for nēnē are not expected to significantly affect the species. Avoidance and minimization measures will most likely altogether prevent any take of nēnē that may incidentally visit the Property. The proposed mitigation measures will therefore contribute to the species' recovery in absence of take, or provide a net conservation benefit in case of incidental take. For this reason, no significant adverse impacts to the species' overall populations, and no significant cumulative impacts to the species, are anticipated.

6.2 Cumulative Impacts to Listed Species

Presently only one incidental take permit has been issued for Blackburn's sphinx moth. Auwahi Wind Farm has obtained a 25-year permit under section 10(a)(1)(B) and HRS 195D for the permanent take of 0.3 acres of degraded habitat with some native species, and an additional 27.7 acres of degraded habitat (Tetra Tech EC, Inc 2012).

Two ESA Section 10(a)(1)(B) permits for nēnē have been issued through an HCP on the Island of Maui (Table 6-4), and one additional permit is pending approval. Take has also been authorized through two Safe Harbor Agreements (SHAs) on Maui (Table 6-4). Under a Safe Harbor Agreement, property owners voluntarily undertake management activities on their property to enhance, restore, or maintain habitat benefiting species listed under the ESA. These agreements assure property owners they will not be subjected to increased property use restrictions if their efforts attract listed species to their property or increase the numbers or distribution of listed species already on their property. The USFWS issues the Applicant a permit which authorizes any necessary future incidental take through Section 10(a)(1)(A) of the ESA. Accordingly, all impacts associated with these Section 10 permits have been mitigated.

Authorized take of nēnē is documented at several locations on Maui (Table 6.4). Since 2006, KWP LLC has documented observed direct take of four full-grown nēnē (Kaheawa Wind Power 2008, 2009.). Since 2005, two nēnē fatalities have been documented at Piʻiholo Ranch, while 48 nēnē have been released at Piʻiholo Ranch (DOFAW 2008). Other developments on Maui with the potential to have cumulative impacts to nēnē include developments that decrease nesting and foraging habitat, as well as golf courses which may attract nēnē to the area, increasing their vulnerability to vehicular collisions or golf ball strikes (USFWS 2005).

Proposed mitigation measures for nēnē at Honuaʻula are expected to more than offset the anticipated take and will contribute to the species' recovery by providing a net conservation benefit, as required by State law. Similar measures are expected for other developments on Maui with the potential to impact nēnē. For this reason, the cumulative impact of take authorized for Honuaʻula combined with previously and future authorized take is not expected to result in a significant cumulative impact to the species.

At a broader scale, Honuaʻula represents one of many development projects that may be expected to occur on the Island of Maui. Some of the causes of decline of the Covered Species, including habitat reduction and fragmentation, may be on the rise due to continued real estate development on Maui, and will likely continue increasing in the future. Even when conducted in compliance with all applicable local, state and federal environmental regulations, there is the potential for cumulative impacts to occur from these projects because many do not trigger review under endangered species provisions and thus are not required to meet the "net environmental benefit" standard. By implementing this HCP, Honuaʻula will ensure that the net effects of this project will contribute to the recovery of the Covered Species, and thus not contribute to cumulative impacts that may occur as a result of these other developments. Currently, the areas of dry to mesic scrub and forest habitats below 5,000 feet (1,525 m) that are, or could potentially be used by the Blackburn's sphinx moth consist of approximately 367,161 acres (148,588 ha) (USFWS 2005). The 130 acres expected to be lost as a result of development of Honuaʻula, represents 0.03% of the presently available or occupied habitat.

Table 6-4: Habitat Conservation Plans and Safe Harbor Agreements for Nēnē.

Permittee	Permit Duration	Location	Species Covered	No. of Permitted Take Over Permit Duration
Habitat Conservation Plan Permits				
Kaheawa Pastures Wind Energy Facility	01/30/2006-01/30/2026	Māʻalaea, Maui	Hawaiian goose	60
Kaheawa Wind Power II	01/04/2012-01/04/2032	Māʻalaea, Maui	Hawaiian goose	30
Auwahi Wind Farm	01/31/2012-01/31/2037	Auwahi, Maui	Hawaiian goose	5
Safe Harbor Agreement Permits				
Molokai Programmatic SHA for Nēnē	04/07/2003-04/07/2053	Island Wide Molokaʻi	Hawaiian goose	Various
Puu O Hoku Ranch – Nēnē Reintroduction	08/22/2001-08/22/2008	Cape Halawa Molokaʻi	Hawaiian goose	>0
Umikoa Ranch	12/05/2001-12/05/2051	Umikoa Ranch, Hawaiʻi	Hawaiian goose	>0
Participants of USDA Farm Bill Conservation Programs	09/12/2007-09/12/2017	Statewide	Hawaiian goose	Various
Piʻiholo Ranch	09/21/2004-09/21/2054	Makawao, Maui	Hawaiian goose	>0

6.3 Assessment of Impact on Critical Habitat

The project site does not currently contain critical habitat for any listed species. However, on June 11th, 2012 USFWS published a proposed rule to list 38 species on Molokai, Lanai, and Maui as endangered and to designate critical habitat for 135 species on Molokai, Lanai, Maui, and Kahoolawe, under the Endangered Species Act of 1973, as amended (77 FR 34464-34775). In addition to designating critical habitat for those species that are proposed for listing as "endangered" under this rule, USFWS also proposes to designate critical habitat for 11 additional species that are already listed, but do not yet have designated critical habitat. Further, USFWS is proposing to revise critical habitat for 85 species that are already listed as threatened or endangered on the four aforementioned Hawaiian Islands. USFWS uses an ecosystem-based approach to the proposed designation and/or revision of critical habitat under this proposed rule in an effort to conserve habitat units that the USFWS has determined to be essential to the conservation of multiple species. The proposed critical habitat includes areas currently occupied by listed species, and areas that are currently unoccupied, as well as areas for which no previous records exist.

The proposed critical habitat designation totals 271,062 acres on Molokai, Lanai, Kahoolawe, and Maui. Forty-seven (47) percent of the area being proposed as critical habitat on those islands is currently already designated as critical habitat. In effect, the proposed rule would result in more than doubling the area of critical habitat currently designated on Maui, and would cover approximately 40% of the land area on the island, 45% of which is privately owned.

Part of the proposed Maui-Lowland-Dry Unit 3, which totals 1,098 acres, is located within the Honua'ula Property. Almost all of the land in proposed Maui-Lowland-Dry Unit 3 that is not part of the project area is land owned by Ulupalakua Ranch, and is being considered for exclusion from critical habitat by USFWS. Maui-Lowland-Dry Unit 3 is proposed designated critical habitat for 19 species: *Alectryon micrococcus, Bidens micrantha* ssp. *kalealaha, Bonamia menziesii*, *Canavalia pubescens, Cenchrus agrimonioides, Colubrina oppositifolia, Ctenitis squamigera, Flueggea neowawraea, Hibiscus brackenridgei, Melanthera kamolensis, Melicope adscendens, Melicope mucronulata, Neraudia sericea, Nototrichium humile, Santalum haleakalae* var. *lanaiense, Sesbania tomentosa, Solanum incompletum, Spermolepis hawaiiensis,* and *Zanthoxylum hawaiiense*. Of these 19 species, only *Canavalia pubescens* (ʻāwikiwiki) (Sect. 3.7.1.1) has been recorded at the project site (Char and Linney 1988; Char 1993, 2004; SWCA 2006, 2009a; Altenberg 2007).

Through the proposed mitigation plan, this HCP will implement measures that benefit some of the 19 listed species with proposed designated critical habitat in Lowland Dry Unit 3. The offsite mitigation areas selected for this plan offer high potential for contribution to recovery due to the presence of primary constituent elements (PCEs) for most of the 19 species. The relative paucity of PCEs for most of the species for which critical habitat is proposed at the Honua'ula project site, combined with the absence of 18 of the 19 species for which Unit 3 is proposed significantly limits the potential contribution of the Honua'ula project site to the recovery of these species in the long term.

As stated in 50 C.F.R. 424.12(b), PCEs are to be determined for each species when designating critical habitat. The proposed rule uses an ecosystem-based approach to determining PCEs, and contains for each critical habitat unit "physical or biological features essential to the conservation of those individual species that occupy that particular unit, or areas essential for the conservation of those species identified that do not presently occupy that particular unit" (FR 77 (112) 34473). These physical and biological features present in the ecosystems are considered to provide the necessary PCEs for each species in the proposed rule (FR 77 (112) 34527). For the 19 species in Lowland Dry Unit 3, these physical and biological features include an elevation range of less than 3,300 ft, annual precipitation of less than 50 in, and substrates including weathered silty loams to stony clay, rocky ledges, and little-weathered lava. These general features are found in most of the southern and western flanks of Haleakala below 3,300 ft and southern and western west Maui. The physical and biological features pertaining to Unit 3 also include canopy species: *Diospyros, Myoporum, Pleomele, Santalum,* and *Sapindus; s*ubcanopy species: *Chamaesyce, Dodonaea, Leptecophylla, Osteomeles, Psydrax, Scaevola,* and *Wikstroemia;* and understory species: *Alyxia, Artemisia, Bidens, Chenopodium, Nephrolepis, Peperomia,* and *Sicyos.* Although these are

generally not uncommon Hawaiian species or genera, only one of the canopy species (*Myoporum*), one of the subcanopy species (*Dodonaea*), and one of the understory species (*Sicyos*) in the list of PCEs are found at the project site. None of these species are particularly common at the project site, or can be considered to be representative of the features or vegetation of the project site. In 2006-2007, SWCA found 16 aʻaliʻi (*Dodonaea viscosa*) in seven locations, 21 naio (*Myoporum sandwichense*) in 17 locations, and 113 ʻānunu (*Sycios hispidus*) at 49 locations (SWCA 2009a).

The proposed project will result in a net conservation benefit to the one species with occupied habitat at the project site, ʻāwikiwiki. As described in section 3.7.1.1, only five individuals have been found within the project area, and all of these plants will be protected within the proposed Native Plant Preservation Area (sect. 7.3.1). This 40 acre Native Plant Preservation area will be managed to remove threats to the species, improve habitat conditions, and the population of the species itself will be enhanced through propagation and outplanting. Under the proposed mitigation plan, an additional population of ʻāwikiwiki will be established at the Kanaio offsite mitigation area (sect. 7.4.1.1). Under current conditions, the few ʻāwikiwiki plants at Honuaʻula are under threat from ungulates, competition from invasive species, and fire, making local recovery potential for the species very low without the measures proposed in this HCP.

Likewise, the proposed critical habitat for ʻāwikiwiki and the additional 18 species not occupying the area will receive more conservation benefit from the proposed onsite and offsite mitigation program (sect. 7.3.1 and 7.4.1) than it would in absence of the project. The loss of approximately 119 acres of this proposed critical habitat will be offset by protection and enhancement, in perpetuity, of 40 acres onsite, and an additional 354 acres offsite on lands owned by Ulupalakua Ranch (fig.7.1). As noted in this HCP, the onsite mitigation involves a perpetual onsite conservation easement, weed control including manual, chemical, and mechanical removal; control of pest animal species, including rats; enhancement of native plant species through propagation and outplanting; exclusion of ungulates; interpretive trail and informational signs. For the offsite mitigation component of the plan, perpetual conservation easements and preservation will be implemented in currently unprotected, privately owned lands in Kanaio, in an area that is widely acknowledge to harbor significant populations of Blackburn's sphinx moth and its native host plants on Maui. In addition, the HCP includes perpetual preservation and restoration of an area within the Auwahi Forest Restoration Project, a currently partially protected, privately owned area that is part of what was once described as one of the richest botanical regions in Hawaiʻi. The offsite mitigation plan involves perpetual conservation easements, exclusion and eradication of ungulates, weed control using chemical, manual, and mechanical removal, and enhancement of native plant species though propagation and outplanting. The mitigation plan will provide for 15 years of funding for habitat improvements, followed by ongoing, perpetual, funding for maintenance of the mitigation sites. Of the total 394 acre mitigation area, 204 acres are situated within proposed Lowland Dry critical habitat. Honuaʻula partners LLC will provide an additional $125,000 to contribute to a fencing project on land identified within proposed Lowland Dry critical habitat (USFWS 2012), with the approval of DOFAW and FWS, as well as fence maintenance and repair through the permit period. At minimum, this will benefit an additional 35 acres of proposed Lowland Dry critical habitat. The impacts to approximately 119 acres of proposed Lowland Dry critical habitat will be offset at a 2:1 ratio, as recommended by USFWS (Dawn Greenlee, pers. comm.) through mitigation on 239 acres on proposed Lowland Dry critical habitat.

The onsite mitigation area falls within the proposed Lowland Dry Unit 3, and the offsite mitigation areas fall within Lowland Dry Unit 1, Montane Dry Unit 1, and Montane Mesic Unit 1. These units include occupied habitat for *Alectryon macrococcus, Bonamia menziesii, Cenchrus agrimonioides, Flueggea neowawraea, Melanthera kamolensis, Melicope adscendens, M. knudsenii, Santalum haleakalae* var. *lanaiense, Sesbania tomentosa, Spermolepis hawaiiensis, Zanthoxylum hawaiiense, Argyroxiphium sandwicense* ssp. *macrocephalum, Asplenium dielerectum, A. peruvianum* var. *insulare, Bidens campylotheca* ssp. *pentamera, Clermontia lindseyana, Cyanea horrida, C. mceldowneyi, C. obtusa, Cyrtandra ferripilosa, C. oxybapha, Diplazium molokaiense, Geranium arboreum, G. multiflorum, Huperzia mannii,* and *Neraudia sericea*; and for two forest birds, the akohekohe (*Palmeria dolei*) and kiwikiu (*Pseudonestor xanthophrys*). These units provide additional unoccupied habitat for *Bidens micrantha* ssp. *kalealaha, Canavalia pubescens, Colubrina oppositifolia, Ctenitis squamigera, Geranium arboreum, Hibiscus brackenridgei, Melicope mucronulata, Neraudia sericea, Nototrichium humile, Solanum incompletum, Alectryon*

macrococcus, Cyanea glabra, C. hamatiflora ssp. *hamatiflora, C. kunthiana, Phyllostegia bracteata, P. mannii, Wikstroemia villosa,* and *Zanthoxylum hawaiiense.* All of the 19 species included in the Lowland Dry Unit 3 are represented in the offsite mitigation areas, and 11 of those have occupied habitat in the proposed critical habitat units within which the proposed offsite mitigation areas are located. Thus, the proposed mitigation plan will improve and conserve occupied as well as unoccupied habitat for all of the 19 affected species. To further benefit species for which Lowland Dry Unit 3 is proposed, a number of these species will be included in the outplanting effort at the offsite mitigation areas, where appropriate. In addition to āwikiwiki, outplantings will include *Bidens micrantha* ssp. *kalealaha, Bonamia menziesii, Cenchrus agrimonioides, Colubrina oppositifolia, Hibiscus brackenridgei, Neraudia sericea, Sesbania tomentosa, Solanum incompletum,* and *Spermolepis hawaiiensis,* to enhance or establish populations of these species at the mitigation sites. Based on biological restrictions, *Ctenitis squamigera, Melanthera kamolensis, Melicope mucronulat.* and *Nototrichium humile* are not appropriate for planting in these areas, and will not be included in the outplantings. The mitigation areas do not provide habitat to support successful protection and conservation of *Flueggea neowawraea, Alectryon macrococcus, Melicope adscendens, Zanthoxylum hawaiiense,* and *Santalum haleakalae* var. *lanaiense*; therefore, these species are also not included in the outplantings at the offsite mitigation areas.

As noted in the proposed rule, the Secretary may exclude an area from critical habitat based on economic impacts, impacts to national security, or any other relevant impacts. The Secretary can consider the existence of conservation agreements, other land management plans and voluntary partnerships with Federal, private, State, and tribal entities when making decisions under Section 4(b)(2) of the ESA. When considering the benefits of exclusion, USFWS considers factors such as whether exclusion of a specific area is likely to result in conservation; the continuation, strengthening, or encouragement of partnerships; or the implementation of a management plan that provides equal to or more conservation than a critical habitat designation would provide. In evaluating the existence of a conservation plan when considering the benefits of exclusion, USFWS considers a variety of factors including, but not limited to, whether the plan is finalized; how it provides for the conservation of the essential physical or biological features; whether there is a reasonable expectation that the conservation management strategies and actions contained in a management plan are likely to be implemented into the future; whether the conservation strategies in the plan are likely to be effective; and whether the plan contains a monitoring program or adaptive management to ensure that the conservation measures are effective and can be adapted in the future in response to new information.

The propsed rule includes a number of areas considered for exclusion from critical habitat designation on the basis of existing voluntary conservation agreements and management plans, including a HCP, to benefit conservation of the affected species and their habitat. Given the benefits of the conservation measures and mitigation plan proposed in this HCP, and the limited resources for most of the 19 species at the Honaua'ula project site, as defined in the proposed rule, the area covered by the HCP may be considered for exclusion.

7 AVOIDANCE AND MINIMIZATION, AND MITIGATION MEASURES

7.1 General Avoidance and Minimization Measures

The analysis of project design alternatives supports the conclusion that the Proposed Action is preferred after consideration of financial feasibility and all impacts on the human and natural environment. Complete avoidance of risk to the Covered Species is impossible under the Proposed Action. Therefore, Honuaʻula Partners, LLC has incorporated a number of measures to avoid and minimize the risk of impacts on Covered Species. Additional measures are included to avoid and minimize risks to other wildlife species that may otherwise be adversely impacted by the project, to minimize impacts on the human environment, and to avoid any impacts to species included in this HCP, but for which take is not requested. General measures apply to both construction and post-construction activities, and additional measures for activities associated with construction and post-construction operations are specified. These measures include, but are not limited to:

7.1.1 Natural Resources Manager

A Natural Resources Manager will be hired as recommended in the Honuaʻula Conservation and Stewardship plan (SWCA 2010a). DOFAW and USFWS may approve the criteria and qualifications for the position, but Honuaʻula Partners, LLC will hire the Natural Resources Manager. Performance of this person will be evaluated against the approved HCP. The Natural Resources Manager's responsibilities will include, but are not limited to: conducting public outreach, supporting plant restoration and propagation efforts, conduct scientific research, controlling and eradicating invasive species from plant preservation and conservation areas, and implementing the goals and objectives of the Honua'ula Conservation and Stewardship Plan. The appointed person will also oversee implementation of other avoidance and minimization measures described in this section during construction and post-construction operations. The Natural Resources Manager will work cooperatively with government and non-governmental organizations including the Maui Invasive Species Committee (MISC), Leeward Haleakalā Watershed Alliance, DLNR, and other organizations.

The Natural Resources Manager will be hired at the start of Phase I of the project, before any major construction activities commence, and will be responsible for designing and implementing any necessary protocols to avoid and minimize impacts to any of the Covered Species. This position will remain filled for the life of the project.

The responsibilities of the Natural Resources Manager as specified in this HCP include:

- Coordinate response to injured or deceased wildlife at the Property (Sect 7.1.2).
- Conduct surveys before, during, and after construction for Blackburn's sphinx moth, Hawaiian short-eared owls, and Hawaiian hoary bat (Sect 7.1.4, Sect 7.1.12, and Sect 7.1.13).
- Keep track of presence and activity of Covered Species at the Property (Sect 7.1.9).
- Ensure golf course Marshalls and Starters receive training in identification of Covered Species, and in measures to avoid and minimize harm to these Covered Species (Sect 7.1.11).
- Implement a program to translocate scattered, rarer, native plants occurring outside of the Native Plant Preservation Area or Plant Conservation Areas to appropriate areas within the boundaries of these protected areas. Additional details may be provided for in the Landscape Plan (Sect 7.3.1).
- Develop a fire plan in consultation with USFWS, DLNR, and other entities as appropriate (Sect 7.3.3).
- Implement a monitoring program in consultation with USFWS, DLNR, and other entities as appropriate (Sect 7.3.3).
- Develop a public education and outreach program (Sect 7.3.3). This will consist of a golf course component, to be completed prior to start of golf course operation, a general local community and general public at large component, and an endangered species awareness component (Sect. 7.1.2). The general education and outreach component will include sponsoring service trips to assist with management activities, field trips for island students, and development of interpretive signs to encourage public cooperation and discourage trespassing through the Native Plant Preservation Area.

- Ensure succession of management of the on-site and off-site mitigation areas, should the assigned manager or organization cease to exist or otherwise become unavailable to manage and execute the mitigation measures.

7.1.2 Endangered Species Education Program

An endangered species education program will be conducted for all regular on-site staff. The program will be long-term, on-going, and updated as necessary. Staff will be trained to identify listed and non-listed native wildlife species that may be found on-site, to record observations of species protected by the ESA, HRS 195, and/or MBTA, and to take appropriate steps when and if injured or deceased wildlife is found (see Appendix 7).

As part of their safety training, temporary employees, contractors, and any others that may drive project roads will be educated as to project road speed limits, the possible presence of injured or deceased wildlife on roads, and the possibility of nēnē and Hawaiian short-eared owls on roads. These types of personnel will be instructed to contact the Natural Resources Manager immediately if they detect any injured or deceased wildlife on-site.

Construction Phase Avoidance and Minimization Measures

7.1.3 Endangered Species Construction Contract Provisions (Including BMPs)

Honuaʻula Partners, LLC will develop provisions and restrictions, which may be based on the Best Management Practices described in the HCP, to avoid and minimize impacts to Covered Species. These provisions and restrictions will apply to all construction activities planned for areas in which Covered Species may occur. These provisions will be inserted into construction contracts for these activities.

7.1.4 Pre-Construction Wildlife Surveys

The Natural Resources Manager will conduct surveys of any areas that will be subject to large-scale construction activities, such as mass-grading. The main focus of these surveys will be on Blackburn's sphinx moths and Hawaiian Short-eared owls. Surveys will be of sufficient scope and duration to detect these species, and survey protocols will be review by the agencies prior to any ground-breaking activities.

Potential larval host plants for the Blackburn's sphinx moth, including tree tobacco and other plants in the Solanaceae family, will carefully be examined before removal. If sign or larvae are found, the Natural Resource manager will assure the steps outlined in the most recent USFWS guidelines (Appendix 11, as updated via adaptive management) for avoiding Blackburn's sphinx moth take are followed.

The Hawaiian short-eared owl, which is not listed as threatened or endangered on the island of Maui, has been observed at the Property, and may roost or even nest in low vegetation or nest on the ground within the Property. As Hawaiian short-eared owls breed year round, it is not possible to time vegetation clearing activities to avoid potential for conflict with nesting by this species. The Natural Resources Manager will conduct systematic surveys to detect any Hawaiian short-eared owl nesting activity. Vegetation clearing will be suspended within 300 ft (91 m) of any area where distraction displays, vocalizations, or other indications of nesting by adult Hawaiian short-eared owls are seen or heard, and resumed when it is apparent that the young have fledged or other confirmation that nesting is no longer occurring.

7.1.5 Fencing

The entire perimeter of the Property has already been fenced to exclude cattle from the kiawe-wiliwili shrubland. This fence will be replaced during Phase I with an ungulate-proof fence to effectively exclude non-native axis deer, goats, as well as cattle from further damaging native plants. The fence will be constructed using corrosion-resistant galvanized steel materials, and will be approximately eight feet in height with mesh size of no more than six inches. All ungulates will be removed from the Property using humane methods, as described in the Animal Management Plan for Honuaʻula (SWCA 2010a). Temporary fences will be erected around the native plant preservation and conservation areas to prevent any construction-related impacts to native plants and cultural sites in these areas. This may include the use of silt fencing to limit sediment runoff from upslope construction areas. All fencing will be inspected on a daily basis and repaired when necessary.

7.1.6 Best Management Practices

Honuaʻula Partners, LLC will implement best management practices to ensure that construction activities do not harm any Covered Species at the Property, and to minimize erosion and sedimentation runoff. These measures include those outlined in the Transportation Management Plan by Austin, Tsutsumi, and Associates Inc. (2009) and approved by both the County of Maui and Hawaiʻi Department of Transportation and measures recommended by the U.S. Fish and Wildlife Service (Apr 08, 2009) with regard to minimizing impacts to natural resources (Appendix 6). These measures include, but are not limited to:

- Erecting signs to delineate parking areas, speed limits, disposal sites, etc.
- Careful selection of a staff parking area at a sufficient distance from the on-site Native Plant Preservation Area and Plant Conservation Areas to minimize potential impacts to resources and wildlife protected in those areas.
- Establishing a speed limit of 15 miles per hour for all vehicular traffic at the Property to limit strike hazard to Covered Species, in particular nēnē and short-eared owls.
- Limiting outdoor lighting to the period outside of fledging season for the endangered Hawaiian petrel and Newell's shearwaters, which falls between September 15 and December 15. In compliance with DOH regulations, construction can only be performed between 7:00 a.m. and 6:00 p.m., Monday through Friday, and 9:00 a.m. and 6:00 p.m. on Saturdays (Austin, Tsutsumi and Associates, Inc, 2009). Therefore, no nighttime construction will be performed. However, if outdoor lighting is required during construction, the use of lights should be limited during the fledging season for the endangered Hawaiian petrel and Newell's shearwaters (September 15- December 15).
- Establishing appropriate buffer zones around any candidate, threatened, or endangered species found at the Property during the pre-construction surveys, until threat to the species no longer exists (see section 7.1.2.4).
- Implementing deterrent methods to keep endangered waterbirds from utilizing temporary retaining basins during construction.
- Installing sediment barriers such as silt fencing along the bottom of a slope and down gradient of a disturbed area, especially in areas upslope of the Native Plant Preservation Area and Plan Conservation Areas.

<u>Operation Phase Avoidance and Minimization Measures</u>

7.1.7 Roadways (Speed Limit)

Permanent speed limits will be posted throughout the Property to minimize collision with Covered Species and other native wildlife. In addition, speed bumps will be installed on roadways wherever necessary to ensure compliance with posted speed limits. Speed limits across the Property will be 15 mph. If one or more nēnē do become present on the Property, specific signs signaling their presence along roads will be installed.

7.1.8 Seabirds: Lighting

External lighting at the Property and its associated buildings and facilities are subject to Maui County Code Title 20, Chapter 35, regulating outdoor lighting standards. This chapter prohibits the use of broad-spectrum mercury vapor lights, and mandates that lights are either fully shielded, or imposes usage restrictions on lights that may be partially shielded. These conditions are intended to minimize fallout of juvenile seabirds.

In addition, external light at the Property will be designed to ensure that light attraction to seabirds is minimized to the maximum extent practicable. External lighting associated with the proposed development, including parking areas, accent lighting, and external building illumination, will follow existing recommendations from USFWS (Appendix 10) and will be of the following types: shielded lights, cut-off luminaries, or indirect lighting.

7.1.9 Management and Maintenance

Regular management and maintenance activities at the Property are not expected to result in any adverse impacts to Covered Species. However, the following steps will be taken to further ensure the minimization and avoidance of impacts:

- The Natural Resources Manager will notify management and maintenance personnel of the location of any nests or individuals of Covered Species, and will provide guidelines on avoiding impacts to these species.
- All management and maintenance staff will be required to attend the endangered species training, described above, on an annual basis.
- Management and maintenance staff will report all activity and presence of Covered Species at the property to the Natural Resources Manager.

7.1.10 Owners and Residents (Covenants, Conditions and Restrictions; CC&R)

To assure compliance with conditions associated with lighting, leash laws, landscaping and others that may affect Covered Species, the Applicant may include provisions in the CC&Rs.

7.1.11 Golf Course Operations

Concerns with regard to attraction of nēnē and waterbirds and subsequent impacts on these species are primarily related to golf course features. Because the golf course will not contain any permanent water features, attraction of waterbirds to the Property is not expected, however, any measures described below to minimize harm to nēnē, may also be applied to other waterbirds if, for unforeseen reasons, they do become attracted to features associated with the golf course.

- All management and golf-course maintenance staff will be required to attend the endangered species training annually.
- The Natural Resources Manager will ensure that the golf course Marshalls and Starters receive training in identification of Covered Species, and in measures to avoid and minimize harm to the Covered Species. This may include measures in response to injured or dead Covered Species, non-harmful means to encourage Covered Species to leave areas in which they are at risk of harm, or measures to discourage them from occupying such areas. This training will be in addition to the regular required endangered species education.
- If Covered Species are observed or anticipated at the golf course, the Natural Resources Manager will brief the golf course personnel on the status of these species at the golf course, and provide instructions on appropriate measures to minimize or avoid harm to these species.
- When Covered Species are observed or anticipated at the golf course, the golf course Starter will inform every golfer about the presence of the Covered Species. Each golfer will receive a briefing including information about the protected status of the Covered Species under the ESA and HRS 195D, the necessity of taking measures to avoid harm to the species, and about any golf course rules that apply to these situations.

- If Covered Species are observed foraging, transiting, or even nesting at areas of the golf course where they may be at significant risk of harm from golf-related activities, the Natural Resources Manager, marshal, or Starter may temporarily halt play in that location until the animals have relocated.
- If any dead or injured Covered Species are found on the golf course a wildlife recovery and response protocol will be implemented. This protocol will be developed with consultation of USFWS and DLNR, and a draft is included in Appendix 7.
- An endangered species education program will be developed for the golf course. Features that may be included in this education program are brochures or placards to be issued to each golfer, educational materials such as informational panels or posters will be placed at the pro shop or an educational kiosk. An educational program is anticipated to be very effective, since this will be a private golf course, and most players will be regulars and residents of the development.
- Players will be instructed to contact the Starter or Marshall on duty when Covered Species are observed on the golf course, or when there are any concerns regarding Covered Species.

7.1.12 Avoidance Measures for the Hawaiian Hoary Bat

Trees 15 feet or more in height will not be cleared for construction between June 1 and September 15 when non-volant Hawaiian hoary bat juveniles may be present at the Property, pursuant to recent USFWS guidance based on available literature and data. The Natural Resources Manager or other qualified wildlife biologist will monitor for bats prior to vegetation clearing to further insure no impacts to juvenile bats will occur.

Any fences built for the project will have a barbless top-strand of wire to prevent entanglements of the Hawaiian hoary bat on barbed wire.

7.1.13 Avoidance Measures for Direct Take of Blackburn's Sphinx Moths

To avoid direct take of Blackburn's sphinx moths, Honuaʻula Partners, LLC will follow the USFWS protocol (Appendix 11) for the removal of tree tobacco. This includes measures such as checking trees for sign of larvae, leaving trees with larvae or sign of larvae for 30 days, cutting trees without sign or larvae at ground level and leaving the root ball and soil in the surrounding 30 foot (10 m) radius for a period of one year before ground disturbance. Checking trees for presence or sign of larvae will be overseen by Natural Resource Manager or other delegated personnel trained by the Natural Resource Manager.

Impacts to Blackburn's sphinx moths resulting from light attraction at Honuaʻula are not considered likely. Moths are known to be attracted to lights and light attraction may cause the moth to strike an object or otherwise fall to the ground where it could be exposed to predation or other stressors. USFWS has acknowledged that quality of darkness may be a factor in adult Blackburn's sphinx moth behavior, but this issue was not taken into account when critical habitat was designated due to a lack of prior studies of the issue (USFWS 2003). Flight to light distances of sphingid moths have been shown to be less than 33 feet (10 m), and the effective radius of a 125 watt mercury vapor light is a mere 9 feet (3 m) (Frank 2006). The short flight to light distance along with a very low density of moths results in a very low expected risk of light impacts to Blackburn's sphinx moths at Honuaʻula. Furthermore, the Property is located within an urban area that already has a high level of ambient lighting. This minimizes the chances of light attraction for moths by reducing flight to light behavior (Frank, 1988, 2006). This would significantly dilute the effect of additional lights installed at Honuaʻula. Nonetheless, potential impacts will be avoided by reducing light pollution as recommended by the USFWS for avoidance of light impacts to seabirds. In addition, light fixtures will be placed away from areas in which moths may become trapped and tightly sealed to avoid entrance of moths as recommended by Frank (2006).

External lighting at the Property and its associated buildings and facilities are subject to Maui County Code Title 20, Chapter 35, regulating outdoor lighting standards. This chapter prohibits the use of broad-spectrum mercury vapor lights, and mandates that lights are either fully shielded, or imposes usage restrictions on lights that may be partially shielded.

7.2 Selection of Mitigation Measures

Honuaʻula Partners, LLC coordinated with biologists from USFWS, DOFAW, SWCA, and members of the ESRC to identify and select appropriate mitigation measures to compensate for the potential incidental take of two Federal and/or State-listed species during construction or operations at the Honuaʻula Property. In addition, mitigation is designed to ensure USFWS and DOFAW Permit issuance criteria are met. The criteria used for determining the most appropriate mitigation measures include:

1. The level of mitigation should (at least) be commensurate with the currently anticipated take;
2. Mitigation should be species-specific and, to the extent practicable, location or island specific;
3. Mitigation measures should be practicable and capable of being done given currently available technology and information;
4. Mitigation measures should have measurable goals and objectives that allow success to be assessed;
5. Mitigation measures should be flexible to adjust to changes in the level of take according to new information during project operation;
6. Should be consistent with or otherwise advance the strategies of the respective species' draft or approved recovery plans;
7. Mitigation measures that serve to directly "replace" individuals that may be taken (e.g., by improving breeding success or adult and juvenile survival) are preferred, though efforts to improve the knowledge base for poorly documented species also have merit, particularly when the information to be gained can benefit future efforts to improve survival and productivity;
8. Off-site mitigation measures of resources located on otherwise unprotected private land are preferred over those on public land, and sites on state land are preferred by USFWS over those on federal land;
9. Measures to decrease the level of take resulting from a private activity unrelated to the project are generally considered the responsibility of the other party and are not preferred as mitigation; and
10. Alternate or supplemental mitigation measures should be identified for future implementation if the level of take is found to be higher (or lower) as a result of monitoring.

Federally and/or State-listed species considered to have potential to be incidentally taken during the life of the project are the Blackburn's sphinx moth, and the Hawaiian goose, or nēnē. The mitigation proposed to compensate for impacts to these species is based on anticipated levels of incidental take as determined through on-site surveys, off-site information gathering, and modeling. The primary goal of the proposed mitigation measure is to directly offset habitat lost at the Property, and increase populations of the Covered Species to aid their recovery.

7.3 General Measures

This plan addresses general mitigation measures designed to minimize and offset loss of habitat and components of the native communities at the Property as a result of construction and operation of Honuaʻula, that are in addition to the required mitigation measures for take of, or loss of habitat for, Covered Species. The general mitigation measures are the establishment of an on-site plant conservation easement and the implementation of a conservation plan. In addition to these measures, native plants will be protected and managed within Plant Conservation Areas located throughout the Property.

7.3.1 Native Plant Preservation Area

Honuaʻula Partners, LLC will establish a perpetual on-site conservation easement over an area of approximately 40 acres within the remnant kiawe-wiliwili shrubland (Figure 1.2), which will encompass most nehe (*Lipochaeta rockii*) plants as well as all ʻāwikiwiki (*Canavalia pubescense)* plants found at the Property (Table 6.1). The easement will be established at the initiation of Phase I construction. The scope of the Native Plant Preservation Area will be set forth in an agreement between Honuaʻula Partners, LLC and the County that shall include: 1) a commitment from Honuaʻula Partners, LLC, its successors and permitted assigns, to protect and preserve the Native Plant Preservation Area for the protection of native Hawaiian plants; 2) use of the Native Plant Preservation Area will be confined to activities consistent with the purpose and intent of the Native Plant Preservation Area; and 3) no development other than fences, and interpretive trails will be allowed within the Native Plant Preservation Area. Interpretive trails will be minimal in size, and shall not consist of imported materials, hardened surfaces, and care will be taken to minimize impacts to native plants during establishment of trails. Existing jeep roads will be used to the maximum extent practicable.

The Native Plant Preservation area will consist of two separate, but conjoined easements (figure 1.2). Easement A, the eastern portion of the Native Plant Preservation area comprises approximately 4 acres. Easement B contains the remaining area of approximately 36 acres. The purpose of establishing two separate easements is to allow for a simple, minimal golf cart path through easement A to connect golf course hole 10 with tee 11. The easements will be substantively identical in all other material respects. This paved path will be approximately 10 feet wide and will have no lights. Only golf carts and no other vehicles will be allowed passage. The acreage of easement A will be slightly more than 4 acres to include the area occupied by the golf cart path, so 4 acres will be conserved at a minimum. Other than the provision for the golf cart path in easement A, both easements will be identical.

Title to the Native Plant Preservation Area will be conveyed to a land trust or non-profit organization that holds other conservation easements prior to Phase 1 construction. Access to the area will be permitted pursuant to an established schedule specified in the Conservation / Preservation Plans to organizations on Maui dedicated to the preservation of native plants, to help restore and perpetuate native species and to engage in needed research. These organizations may enter the Native Plant Preservation Area at reasonable times for cultural and educational purposes only.

The Native Plant Preservation Area will initially be protected by a construction grade perimeter fence, which eventually will be replaced by a rock wall with the primary purpose of minimizing trespassing. In the event that the entire Property is fenced at the start of construction, the temporary fencing around the Native Plant Preservation Area may be limited to temporary construction fences or similar barriers, to protect the area from accidental impacts from construction activities.

Invasive weeds will be removed from the preserve and total cover of all invasive plants will be maintained at less than 50%. Incipient weed removal will be ongoing. Tree tobacco will not be removed from the preserve as this is a recognized host plant for the Blackburn's sphinx moth, unless directed to do so by USFWS and DOFAW. These agencies may establish a maximum stem count to limit the abundance of tree tobacco in the Native Plant Preservation Area. Weed control may include manual, mechanical, or chemical control methods, or a combination of these methods. Specific species, currently occupying the site, to be targeted include koa haole, guinea grass, and other fire-prone alien grasses. Rats, which limit recruitment of native plants through browsing and seed predation, will be controlled using appropriate bait stations and/or traps in a grid throughout and

around the preserve. Methods will be developed through consultation with U.S. Department of Agriculture Animal Damage Control, USFWS and DLNR. State Department of Health (DOH) best management practices will be implemented. Restricted pesticide use will be performed or overseen by a licensed applicator, and in coordination with applicable government conservation agencies as required by the label. Feral ungulates will be excluded from the entire Property and will no longer be a threat to the native plants within the Native Plant Preservation Area.

The Natural Resources Manager will implement a program to translocate scattered, rarer, native plants occurring outside of the Native Plant Preservation Area or Plant Conservation areas (see section 7.3.2 below) to appropriate areas within the boundaries of these protected areas. If necessary, conditions may be temporarily improved to augment the health of rare (non-listed) species by supplying supplemental shade, water, fertilizer, or mulch. In addition, propagated dry forest plant species may be out-planted within the Native Plant Preservation Area, as appropriate. This may include native host plants for the Blackburn's sphinx moth. The primary constituent elements for Blackburn's sphinx moth larvae, ʻaiea (*Nothocestrum* spp.) will be considered for propagation and out-planting at the Native Plant Preservation Area. The outcome of this effort is unknown because the Property lies at lower elevation than the distribution reported for the species (Wagner et al 1999). Considerations and plans for translocating and outplanting at the Property may be provided for in the Landscape Plan.

7.3.2 Plant Conservation Areas

In addition to the Native Plant Preservation Area described above, Plant Conservation Areas will be located throughout the Property adjacent to both the golf courses and the Native Plant Preservation Area. The areas will include all the existing natural gulches throughout the Property (28 acres), as well as ungraded conservation areas (8 acres) in which existing native plants will be protected and which will be managed as natural areas, and areas containing naturalized landscape and in which existing native vegetation will be conserved or enhanced. These areas combined will add an additional conservation area of 36 acres in which existing native plants will be protected. Management strategies employed for these Plant Conservation Areas may include measures listed above for the Native Plant Preservation Area (Section 7.3.1). Due to the fragmented nature of these areas, these will be considered part of the area in which habitat take occurs for purposes of the HCP, even though native plants will be protected in these areas.

7.3.3 Conservation Management Plan

Honuaʻula Partners, LLC will implement a management plan based on a Conservation and Stewardship Plan (CSP) prepared by SWCA and published in the Final EIS (PBR Hawaiʻi 2012). The purpose of this management plan was to identify measures to be taken to avoid and minimize impacts including establishment and management of a perpetual on-site native plant preservation easement. The goals and main elements of this plan have been incorporated into this HCP. The management plan will be revised and finalized prior to the start of Phase 1 construction based on agency and public comments on this HCP. The goals of the CSP are to preserve elements of the remnant kiawe-wiliwili shrubland, as much as possible, and to protect native plants and animals within the immediate area affected by construction of the proposed Honuaʻula community. The secondary goals of the CSP are to cooperate with researchers in furthering the science of native plant propagation, provide education and outreach opportunities, and enhance the natural beauty of the proposed Honuaʻula project. CSP objectives, some of which have been described above as part of the avoidance and minimization strategy and in the description of the on-site Native Plant Preservation Area and Plant Conservation Areas, include:

i. Establish a position for an on-site Natural Resources Manager (Sect. 7.1.1.1).
ii. Construct a deer fence around the eastern and southern boundaries of the 670-acre Property (Sect. 7.1.1.5).
iii. Remove all ungulates from within the entire Property (Sect 7.1.1.5).
iv. Control noxious invasive plants (Sect. 7.3.1; 7.3.2).
v. Protect and propagate native plants from local seed stocks (Sect 7.3.1; 7.3.2).
vi. Attempt to propagate native host plants for Blackburn's sphinx moth within the Native Plant Preservation Area (Sect 7.2.1)
vii. Develop a fire control plan (Natural Resources Manager in consultation with USFWS, DLNR, and other entities as appropriate). The purpose of this plan is protection of the Native

Plant Preservation Area and the Plant Conservation Areas from fire damage. This plan will be in place before ungulates are removed from the Property.

viii. Control of non-native seed predators to the maximum extent practicable.

ix. Implement a monitoring program (Natural Resources Manager in consultation with USFWS, DLNR, and other entities as appropriate). The purpose of this monitoring will be to accurately establish a baseline to evaluate efficacy of management activities, and identify threats to the Native Plant Preservation Area.

x. Landscape the Property with native plants from local seed stock.

xi. Manage the Native Plant Preservation Area and the Plant Conservation Areas with the cooperation of stakeholders: Honua'ula Partners, LLC will attempt to involve a wide range of stakeholders in the management of the Native Plant Preservation Area. The Natural Resources Manager will work with the University of Hawaii, Maui Invasive Species Council, Leeward Haleakala Watershed Alliance, State DLNR, and others, as appropriate, to conduct detailed scientific inventories and monitoring programs to develop an accurate baseline and ongoing monitoring to evaluate the efficacy of management activities and identify imminent threats to the preserve. Honua'ula Partners, LLC will make an effort to continually disseminate useful information to all stakeholders.

xii. Develop a public education and outreach program (Natural Resources Manager) (Sect 7.1.1.2). This will include sponsoring service trips to assist with management activities, field trips for island students, and development of interpretive signs to encourage public cooperation and discourage trespassing through the Native Plant Preservation Area.

7.4 Off-Site Mitigation Measures

Mitigation measures to offset impacts to the Blackburn's sphinx moth and its habitat have been designed in consultation with USFWS, DLNR, Dr. Art Medeiros, and Andrea Buckman (Leeward Haleakala Watershed Restoration Partnership), Dr. Dan Rubinoff (Lepidopterist, UH Mānoa), and facilitated with the cooperation of Mr. Sumner Erdman (ʻUlupalakua Ranch). This process included identification of:

a) Other areas on Maui containing valuable habitat for Blackburn's sphinx moths;
b) Management and protection of these areas from current and future threats, and;
c) Availability of these areas for perpetual conservation easement.

The assessment of suitable off-site mitigation areas has focused on areas with similar geology as the Property in areas where restoration of native larval host plants (i.e. *Nothocestrum*) is feasible. Lands that were taken into consideration include Puʻu o Kali, Auwahi, Ahihi-Kinaʻu, and Kanaio areas, as well as parcels within Mākena Resort and ʻUlupalakua Ranch located adjacent to the Property. It might be argued that some of these areas are more similar to the Project area in terms of geology, slope, rainfall, and plant species composition; however these areas are either not available for purchase or transfer, or have been excluded as mitigation options by USFWS or DLNR because they are already protected. Honuaʻula Partners, LLC has approached Makena Resort, ʻUlupalakua Ranch, Haleakala Ranch, and the State Department of Hawaiian Homelands in efforts to secure mitigation sites in the vicinity of the Property, but none of these options were determined to be appropriate or available mitigation sites. Puʻu o Kali was considered because of its similar geology and plant composition, and because it is considered a high priority area for native dryland species including ones occurring at the Property, but USFWS considered this area to already be protected, and it was subsequently disqualified as a potential mitigation site.

Honuaʻula Partners, LLC proposes to implement significant mitigation measures that will result in a substantial net benefit for the Blackburn's sphinx moth and its native habitat. In addition to establishing and managing the on-site Native Plant Preservation Area (described above), Honuaʻula Partners, LLC proposes two principal Blackburn's sphinx moth mitigation areas: the approximately 164-acre Kanaio mitigation area and approximately 190 acres of the Auwahi Forest Restoration Project site.

7.4.1 Off-Site Mitigation Areas

In addition to the 40 acres of habitat that is being preserved on-site (see Section 7.3.1), Honuaʻula Partners, LLC shall, based on research and consultation with USFWS and DOFAW, mitigate the loss of habitat (130 acres of marginal Blackburn's sphinx moth habitat and 497 acres of severely degraded Blackburn's sphinx moth habitat) at the Property with the perpetual preservation and management of a total of 354 acres of native dry shrubland and forest habitat on privately owned lands at ʻUlupalakua Ranch. This off-site mitigation acreage exceeds USFWS's recommended mitigation offset ratios (two acres conserved and managed in perpetuity for each acre of marginal Blackburn's sphinx moth habitat developed and one fifth of an acre restored and conserved in perpetuity for each acre of degraded moth habitat developed (Dawn Greenlee, pers. comm). Perpetual conservation easements and preservation will be implemented over approximately 164 acres of currently unprotected, privately-owned lands at Kanaio, in an area that is widely acknowledged to harbor significant populations of Blackburn's sphinx moth and its native host plants on Maui. In addition, perpetual preservation and restoration of approximately 190 acres within the Auwahi Forest Restoration Project, a currently partially protected, privately owned land that is part of what was once described as one of the richest botanical regions in Hawaiʻi, will be put into place. In total, 394 acres of Blackburn's sphinx moth habitat will be afforded perpetual preservation and management. This mitigation is expected to result in a net benefit to the Blackburn's sphinx moth pursuant to HRS 195-D and will help increase productivity of moths in the off-site mitigation area that contains a diversity of native larval host plants, some of which are federally and state listed as endangered. Lower-elevation sites considered for mitigation lack native larval host plants and may be surrounded by development and increased risk of mortality for the moths.

7.4.1.1 Kanaio

After close consultation with the federal and state wildlife agencies, a privately-owned, unprotected parcel was identified as particularly high-quality Blackburn's sphinx moth habitat, due to the abundance of both native larval host plants (i.e. *Nothocestrum*) and adult host plants in abundance (Figure 7.1). This mitigation parcel lies adjacent to the eastern border of Kanaio Natural Area Reserve (NAR), which is considered to be the main stronghold for the Blackburn's sphinx moth on Maui, hosting the core population on that island (USFWS 2005, Conant and VanGelder 1998).The proposed Generator Tie Line proposed for Auwahi Wind Farm will cross a cattle corridor between the Kanaio mitigation parcel and the Auwahi mitigation site, and will not cross either mitigation parcel at any point.

The off-site mitigation easement lays within the Kanaio area, which is considered by USFWS (Dawn Greenlee, in maps recently provided to SWCA; USFWS 2005), USGS (Medeiros et al. 1993; and USGS GAP Analysis maps), and VanGelder and Conant (1998) as a premier example of the native dry forest habitat which has been reported to have the highest densities of Blackburn's sphinx moth on Maui (citations above). Interest in the area was sparked in 1984 after the rediscovery of Blackburn's sphinx moth in this area, eventually leading to the establishment of the NAR (Betsy Gagne, NARS Staff DOFAW, personal communication, May 2, 2011). The mitigation parcel is rich in full stature halapepe and ʻaiea trees, as well as tree tobacco, and many native host plants that are consider primary constituent elements for Blackburn's sphinx moth habitat (Medeiros, Loope, and Chimera 1993; LeGrande Biological Surveys 2011).

Following the identification of this prime habitat, Honuaʻula Partners, LLC has been engaged in discussions with the owner of this mitigation parcel, ʻUlupalakua Ranch, and has been able to reach an agreement in principle with ʻUlupalakua Ranch for the conveyance of a perpetual conservation easement over this land as mitigation to offset the loss of Blackburn's sphinx moth at the Property (TMK (2)1-9-001-006 Figure 1.2). To secure this easement, Honuaʻula Partners, LLC will provide the monetary and non-monetary consideration required by ʻUlupalakua Ranch, which will be substantial. The easement will protect in perpetuity a significant area of high-quality habitat that is widely considered to be superior to the marginal habitat at the Property. The easement will be conveyed to a land trust or non-profit organization that holds other conservation easements, approved by DOFAW and USFWS. The easement will be in place prior to initiation of Phase I construction.

Established in 1990, the Kanaio NAR located to the south of the project area encompasses 354 ha (876 ac), portions of which include wiliwili. The reserve is situated between 1100 to 2780 ft (335 to 850 m) elevation on leeward East Maui. The substratum at Kanaio is similar to the southern portion of Honuaʻula and consists of broken ʻaʻā lavas estimated to be less than 10,000 years old (Medeiros et al. 1993). Soils are ʻaʻā flows and very stony lands on a gently sloping (<15%) topography with trench-like channels formed by lava flows when the area was formed. Climate conditions are similar to the Property with arid, windswept conditions and an annual rainfall of approximately 30 inches (750mm). Most of the precipitation comes from periodic Kona storms between October and March (DLNR 2003).

The vegetation at Kanaio can be classified into four different communities, largely determined by the underlying geologic substrate and degree of past disturbance: groves of native trees, native shrublands, lava fields with sparse vegetation, and areas dominated by an assemblage of non-native grasses, shrubs, and herbs. Within the native groves, the reserve contains representatives of three native vegetation types: ʻaʻaliʻi (*Dodonea*) lowland shrublands, lama (*Diospyros*) forest, and wiliwili (*Erythrina*) forest. Although they are highly disturbed and altered, these groves are among the best examples of Hawaiian dry forest left in the State, and are an important component of Hawaiʻi's overall remaining biodiversity (DLNR 2003).

The proposed Kanaio mitigation parcel (Figure 7.1) is located on the same substrate as Kanaio NAR, and is subject to similar threats from ungulate browsing. Medeiros et al. (1993) and SWCA have found a total of 171 species of plants at the off-site mitigation area, 40 percent of which are native to the Hawaiian Islands (19 indigenous species and 49 endemic species). In contrast, the Honuaʻula Property harbors 146 species of plants overall of which 27 percent are native (26 indigenous species, and 14 endemic species). Refer to the table in Appendix 8 for comparison of

plant species found at the mitigation site and the Property. The vegetation includes all of the elements of the native dry shrubland that is found at the Property, including a similar suite of adult host plants for the Blackburn's sphinx moth, and the larval host plant tree tobacco, as well as ʻaiea. Densities of wiliwili appear to be patchy, but similar to those at the Property. Price et al. (2007) assigned values of 'medium' to 'high' habitat quality for wiliwili within the area encompassing Kanaio and the proposed mitigation area on his habitat quality maps, based on bioclimatic data. The USGS GAP analysis program classified much of the proposed mitigation area at Kanaio as NS: Native shrubland (alien grasses and NS: Native shrubland (Native shrubs), with some patches of XG: Kikuyu grassland/Pasture and Y: Uncharacterized shrubland (Fig 3.2). The Biodiversity Summary and Habitat Quality Assessment by TNC shows the western half of the proposed mitigation site as Threatened Native Ecosystem, and the eastern half as Rapidly Degrading Ecosystem (Fig. 7.2).

The native forests on both the Honua'ula Property and Kanaio have undergone degradation from decades of disturbance, leading to modification of the original habitat. Most notable is the removal of the understory vegetation as a result of grazing and ungulate trampling, which has led to a change in temperature, moisture, and soil chemistry (Medeiros, et al. 1993). As a result there is poor recruitment of the native trees. The understory at Kanaio has been invaded by non-native species, for example the dense mats of kikuyu grass in some areas, further impeding germination and recruitment. Currently the primary threats to the native dry forest community at Kanaio include the activities of feral goats, deer, and stray cattle, invasion of weed species, wildland fires, and the small population sizes of rare native plants. Fourteen of the native plant species found at Kanaio are listed or are being proposed for listing under the Endangered Species Act. Currently no or minimal management is carried out at Kanaio NAR. Tree tobacco is present at Kanaio, and along with the native ʻaiea it serves as habitat for the larvae of the Blackburn's sphinx moth (VanGelder and Conant 1998). The NAR is not completely fenced. Feral ungulates, particularly goats and cattle, freely roam through the NAR with subsequent damage to native plants. Only recently did the USFWS obtain funding to complete fencing of the Kanaio NAR.

A principal method of offsetting the loss of Blackburn's sphinx moth habitat involves acquisition of a 164-acre perpetual conservation easement on a portion of TMK (2)1-9-001-006 owned by Ulupalakua Ranch. This parcel harbors 171 species of plants, 40 percent of which are native to the Hawaiian Islands (19 indigenous species and 49 endemic species). Honuaʻula harbors 146 species of plants, of which 27 percent are native (26 indigenous species, and 14 endemic species). The Ulupalakua parcel lies adjacent to the eastern boundary of State of Hawaiʻi Kanaio NAR, which is considered to contain particularly high quality habitat for the Blackburn's sphinx moth, and contains native dry land habitat and native host plants for the Blackburn's sphinx moth (Figure 7.1).

a. The conveyance of a perpetual easement has been approved by the land owner, and the easement will be established prior to initiation of Phase 1 construction.
b. An 8 foot ungulate fence currently exists along the northeastern border of the mitigation parcel. This fence will be extended along the remaining borders of the site prior to initiation of Phase 1 construction. The fence will be maintained in perpetuity using endowment funds.
c. Ungulates will be removed from the enclosure using professional removal techniques within two years of initiation of Phase 1 construction. Combined with the fencing, this removes one of the primary threats to the existing Blackburn's sphinx moth habitat at the mitigation site. Ungulate removal is anticipated to take two years, after which the area will be monitored for ungulate presence quarterly and kept free of ungulates.
d. A 10-foot wide green fire break will be established along the perimeter of the fence to prevent fires started outside the parcel from entering the mitigation area. Approximately 50% cover of Kikuyu grass will be maintained in the break at a height of less than 6 inches. Kikuyu grass is retards fire and excludes fire-prone weeds (Smith 1985). This fire break will be established over the course of two years and will be maintained in perpetuity. Vegetation within the fire break may be controlled using manual, mechanical, or chemical control methods, or a combination of these methods. If any portion of the mitigation site is impacted by fire, restoration will be initiated within six months. If any portion of the mitigation site is burned at any time after

initiation of Phase I construction at the Property, intensive restoration will be initiated in the burned area within one month.

e. A cross fencing plan for adjacent land is being developed in coordination with the landowner, ʻUlupalakua Ranch. Cross fencing will be designed to facilitate rotating cattle grazing in such a pattern to enhance fire control on grazing lands immediately adjacent to the protected area. Fuel management in the areas below (south) of the restoration site will be adequate to ensure a fire igniting at the road below the site will not spread to the mitigation site's location.
f. The cover of non-native species is reduced, within five years of initiation of Phase I construction, to less than 25% cover. Thereafter, cover of non-native species will be maintained at less than 25% in perpetuity. Cover of native tree, shrub, vine, and herb species that were elements of the original forest community will be restored, where necessary within 15 years of initiation of Phase 1 construction and a native dry forest ecosystem will be maintained on the site in perpetuity.
g. ʻĀwikiwiki is suitable for restoration only at the lower elevation Kanaio mitigation site. The species is a short-lived perennial vine that is easy to propagate but difficult to outplant. The recommended strategy to re-establish ʻāwikiwiki at the Kanaio mitigation area would be to conduct seed scattering and experimentation with outplanting technologies. Between years 10-15, an annual average of 10 mature ʻāwikiwiki plants will be present at the Kanaio mitigation area, with an annual range between 0 to 500 plants. This five-year average and range is based on the following biological and distribution information known about the plant: 1) The life-span and population size of ʻāwikiwiki is highly variable depending on weather conditions. Although detailed studies of population dynamics have not been conducted, observational evidence indicates that the species is particularly susceptible to extensive drought, resulting in high multi-annual fluctuations in population size. 2) Similar to other species that are sensitive to rainfall levels, it is expected that ʻāwikiwiki will be present at the mitigation site in the seed bank or in pods on desiccated vines during dry periods when few ʻāwikiwiki individuals are visible. The seeds of ʻāwikiwiki have physical dormancy and therefore can remain in the seed bank for extended periods of time until more favorable conditions allow for germination (Baskin et al. 1999). 3) Currently, the estimated total population of ʻāwikiwiki is fewer than 200 individuals, reduced from an estimated population of 360-500 individuals in 2010 (USFWS 2010, 2012). This five-year average will be maintained in perpetuity at the Kanaio mitigation site.
h. A minimum of 500 ʻaiea plants will be propagated and outplanted to the Kanaio/Auwahi mitigation sites within 10 years of initiation of Phase I construction. In year 15 of the permit and beyond, a minimum of 550 aiea will be maintained within the mitigation sites.

The perpetual conservation easements will be established prior to initiation of Phase I construction. The further protection measures described above (Items a – g) will be implemented upon issuance or activation of the ITP/ITL, which will occur at the initiation of Phase I construction at the Property. The easements will be conveyed to a land trust or non-profit organization that holds other conservation easements, determined in consultation with DOFAW and USFWS.

7.4.1.2 Auwahi

The mitigation area at Auwahi is part of a large (5400 acres) stand of diverse, native dryland forest. The botanist Joseph Rock (1913) described the Auwahi dryland forest on Maui as one of the richest botanical regions in the archipelago. Since then, ungulates (cattle, deer, and pigs), wildland fires, and invasive plants, especially kikuyu grass, have degraded this dryland forest. The proposed mitigation areas are located in the western portion of the Auwahi dryland forest, where the native tree density is the highest. The substratum in this area is similar to that of Honuaʻula and Kanaio, consisting of broken ʻaʻā lava on relatively young lava flows, less than 10,000 years old. Presumably the rough substrate helped protect it from ungulate browsing and fire, resulting in a higher remaining native plant and tree density (Medeiros et al 1998). Auwahi contains very high native tree diversity, with 50 dryland species, including ʻaiea (*Nothocestrum* spp.) and wiliwili, which is still quite common throughout lower Auwahi (Medeiros et al 2009). Furthermore it provides reliable habitat for the Blackburn's sphinx moth and some native birds, including the

ʻapapane (*Himatione sanguinea*), amakihi (*Hemignathus virens*), pueo (*Asio flammeus*), and rarely the ʻiʻiwi (*Vestiaria coccinea*).

The USGS GAP Analysis Program classified the land cover at Auwahi largely as XG: Kikuyu Grass Grassland/ Pasture, with some NS: Native Shrubland (alien grasses), indicating the prevalence of the kikuyu grass understory. According to the Biodiversity Summary and Habitat Quality Assessment by TNC, the area is characterized as Rapidly Degrading Ecosystem.

The first integrated restoration of Auwahi forest began in 1997 with an interagency effort at the 10-acre Auwahi I enclosure (USGS 2006). The area was fenced and ungulates were excluded. By 2000, kikuyu grass was virtually eliminated from the enclosure with herbicide (1% glyphosate), and its cover was reduced to 2%. Since 2000, volunteer out-planting trips were organized to plant quick growing native plant species, especially ʻaʻaliʻi (*Dodonaea viscosa*), to create microhabitat through shade and leaf litter and deter establishment of non-native species such as grasses and *Bacconia frutescens* (Papaveraceae). Natural reproduction of native species was first observed in 2002. After ten years of restoration, 28 native species were naturally reproducing within the enclosure. In 2009, a much larger enclosure was built at Auwahi, protecting approximately 190 acres of dryland forest, and encompassing the first two Auwahi enclosures (Figure 7.1). Aside from being an unprecedented dryland forest restoration potential, this project will also provide opportunities to study limitations and threats to Hawaiian dryland forests.

Honuaʻula Partners, LLC has been engaged in discussions with the owner of this mitigation parcel, Ulupalakua Ranch, and has been able to reach an agreement in principle with ʻUlupalakua Ranch for the conveyance of a perpetual conservation easement over this land as mitigation to offset the loss of Blackburn's sphinx moth and native plan habitat at the Property. To secure this easement, Honuaʻula Partners, LLC will provide the monetary and non-monetary consideration required by ʻUlupalakua Ranch, which will be substantial. It is expected that the easement will be conveyed to a land trust or non-profit organization that holds other conservation easements determined in consultation with DOFAW and USFWS.

The Auwahi mitigation area will be secured through the enhancement, restoration, and management of 190 acres of a currently unrestored portion of the Auwahi Forest Restoration Project, on land owned by ʻUlupalakua Ranch. The Auwahi Forest Restoration Project is located just north of the above mentioned Kanaio parcel, from which it is only separated by a narrow cattle corridor (Figure 7.1). Habitat restoration is proven to work at this site. After only ten years of restoration efforts at the first Auwahi enclosure, 28 native species were naturally reproducing at the site, including the native larval Blackburn's sphinx moth host plants, as well as native nectar plants.

a. The conveyance of a perpetual easement has been approved by the land owner, and the easement will be established prior to initiation of Phase 1 construction.
b. An 8 foot fence already exists surrounding the approximately 190 acre Auwahi Forest Restoration Project, but ungulate grazing continues in most of the area within the enclosure. As restoration of the site progresses fences will be moved or installed and ungulates will be removed from restoration areas and restoration areas will be kept clear of ungulates.
c. A 10-foot wide green fire break will be established along the perimeter of the fence to prevent fires started outside the parcel from entering the mitigation area. Approximately 50% cover of Kikuyu grass will be maintained in the break at a height of less than 6 inches . Kikuyu grass is retards fire and excludes fire-prone weeds (Smith 1985). This fire break will be established over the course of two years and will be maintained in perpetuity. Vegetation within the fire break may be controlled using manual, mechanical, or chemical control methods, or a combination of these methods. If any portion of the mitigation site is impacted by fire, restoration will be initiated within six months. If any portion of the mitigation site is burned at any time after initiation of Phase I construction at the Property, intensive restoration will be initiated in the burned area within one month.
d. This area is included in the cross fencing plan described in item e in section 7.4.1.1. As it relates to protection of the approximately 190 acre Auwahi Forest Restoration Project, fuel management in the areas below (south) of the restoration site will be

adequate to ensure a fire igniting at the road below the site will not spread to the mitigation site's location.

e. Kikuyu grass (*Cenchrus clandestinus*) will be removed using a combination of mechanical and chemical removal techniques. The cover of non-native species is reduced, within five years of initiation of Phase I construction, to less than 5% cover. Thereafter, cover of non-native species will be maintained at less than 5% in perpetuity.
f. Native tree, shrub, vine, and herb species that were elements of the original forest community will be replanted. A combined minimum of 500 ʻaiea plants will be propagated and outplanted to the Kanaio/Auwahi mitigation sites within 10 years of initiation of Phase I development. By year 15 of the permit and beyond, a minimum of 550 ʻaiea will be maintained within the mitigation site.

The perpetual conservation easements will be established prior to initiation of Phase I construction. The further protection measures described above (Items a – f) will be implemented in phases at the initiation of Phase I, II, or III construction at the Property, based on federal requirements for mitigation area. The easements will be conveyed to a land trust or non-profit organization that holds other conservation easements, determined in consultation with DOFAW and USFWS.

7.4.1.3 Protection Offered by Conservation Easements

The offsite mitigation parcels are presently encumbered by an agricultural conservation easement, which protects the site from development but still allows agriculture, including cattle grazing and the development of alternative energy such as wind farms, solar, and geothermal energy generating facilities. The proposed conservation easements will protect the parcels from all forms of land disturbance, including the aforementioned uses, and will only allow activities consistent with conservation of native flora and fauna. The Auwahi mitigation parcel is presently encumbered by a temporary, 10-year easement to facilitate the construction of the USFWS-funded perimeter fence, which has been completed.

7.4.2 Measures of Success

Success of the on- and offsite mitigation efforts for the Blackburn's sphinx moth will be determined as follows:

Honuaʻula

1. A 40 acre conservation easement has been established at Honuaʻula, and its active management plan has been implemented.
2. Ungulates are not present within the site.
3. Native plants dominate the site and non-native plant cover is less than 50 percent. If any portion of the mitigation site is impacted by fire, restoration will be initiated within six months. If any portion of the mitigation site is burned at any time after initiation of Phase I construction at the Property, intensive restoration will be initiated in the burned area within one month.
4. No more than one percent of the area is impacted by hiking trail development,
5. Lights in the vicinity of the Native Plant Preserve are shielded so they are not directly visible from within the Native Plant Preservation Preserve.

Kanaio

1. A 164-acre permanent conservation easement, approved by the Agencies, is in place for the ʻUlupalakua Ranch parcel adjacent to Kanaio prior to the initiation of Phase I construction.
2. An 8-foot tall ungulate fence has been established around the three remaining sides of the easement within two years of initiation of Phase I construction at the Property.
3. Ungulates have been removed within two years of the initiation of Phase I construction at the Property.
4. Cross fencing and fire breaks have been established as described within two years of initiation of Phase I construction at the Property. Fuel management in the areas below (south) of the restoration site will be adequate to ensure a fire igniting at the road below the site will not spread to the mitigation site's location. If any portion of the mitigation site is impacted by fire, restoration will be initiated within six months. If any portion of the mitigation site is burned at any time after initiation of Phase I construction at the Property, intensive restoration will be initiated in the burned area within one month.
5. Within 15 years of commencement of mitigation, the number of adult and larval host plants of the Blackburn's sphinx moth, including ʻaiea, morning glory, halapepe, maiapilo, and ʻilieʻe, will, on average, be higher than the number present prior to mitigation. The average number of adult and larval host plants growing at the site in year 10-15 of this HCP will be maintained (within 20%, and as modified, with the concurrence of the Agencies, to account for changed circumstances) in perpetuity.
6. A combined minimum of 500 ʻaiea plants are propagated and outplanted to the Kanaio/Auwahi mitigation sites within 10 years of initiation of Phase I construction. In year 15 of the permit and onward, there are minimum of 550 ʻaiea within the mitigation sites.
7. The cover of non-native species is reduced, within five years of initiation of Phase I construction, to less than 25% cover. Thereafter, cover of non-native species will be maintained at less than 25% in perpetuity.

8. Between years 10-15, an annual average of 10 mature ʻāwikiwiki plants will be present at the Kanaio mitigation area, with an annual range between 0 to 500 plants. This population will no longer require outplantings to maintain stable and increasing cover trend, and will be maintained in perpetuity.

Auwahi

1. A 190-acre permanent conservation easement has been transferred for the ʻUlupalakua Ranch parcel adjacent to Kanaio prior to initiation of Phase I construction.
2. Ungulates have been fenced out and removed within two years of the initiation of Phase I construction at the Property.
3. Cross fencing and fire breaks have been established as described within two years of initiation of Phase I construction at the Property.
4. Restoration activities have been completed prior to the expiration of the permit, including the planting of ʻaiea and adult host plants.
5. The number of adult and larval host plants of the Blackburn's sphinx, including ʻaiea, morning glory, halapepe, maiapilo, and ʻilieʻe, moth has increased over the life of the permit.
6. Fuel load and wildfire frequency have not increased.
7. Within 15 years of commencement of mitigation, the number of adult and larval host plants of the Blackburn's sphinx moth will, on average, be higher than the number present prior to mitigation. The average number of adult and larval host plants growing at the site in year 10-15 of this HCP will be maintained (within 20%, and as modified, with the concurrence of the Agencies, to account for changed circumstances) in perpetuity. The 190-acre conservation area remains native forest in perpetuity.
8. A combined minimum of 500 aiea plants are propagated and outplanted to the Kanaio/Auwahi mitigation sites within 10 years of initiation of Phase I development. By year 15 of the permit and in all subsequent years, there are minimum of 550 aiea within the mitigation sites.
9. The cover of non-native species is reduced, within five years of initiation of Phase I construction, to less than 5% cover. Thereafter, cover of non-native species will be maintained at less than 5% in perpetuity.

Figure 7.1: Offsite mitigation areas.

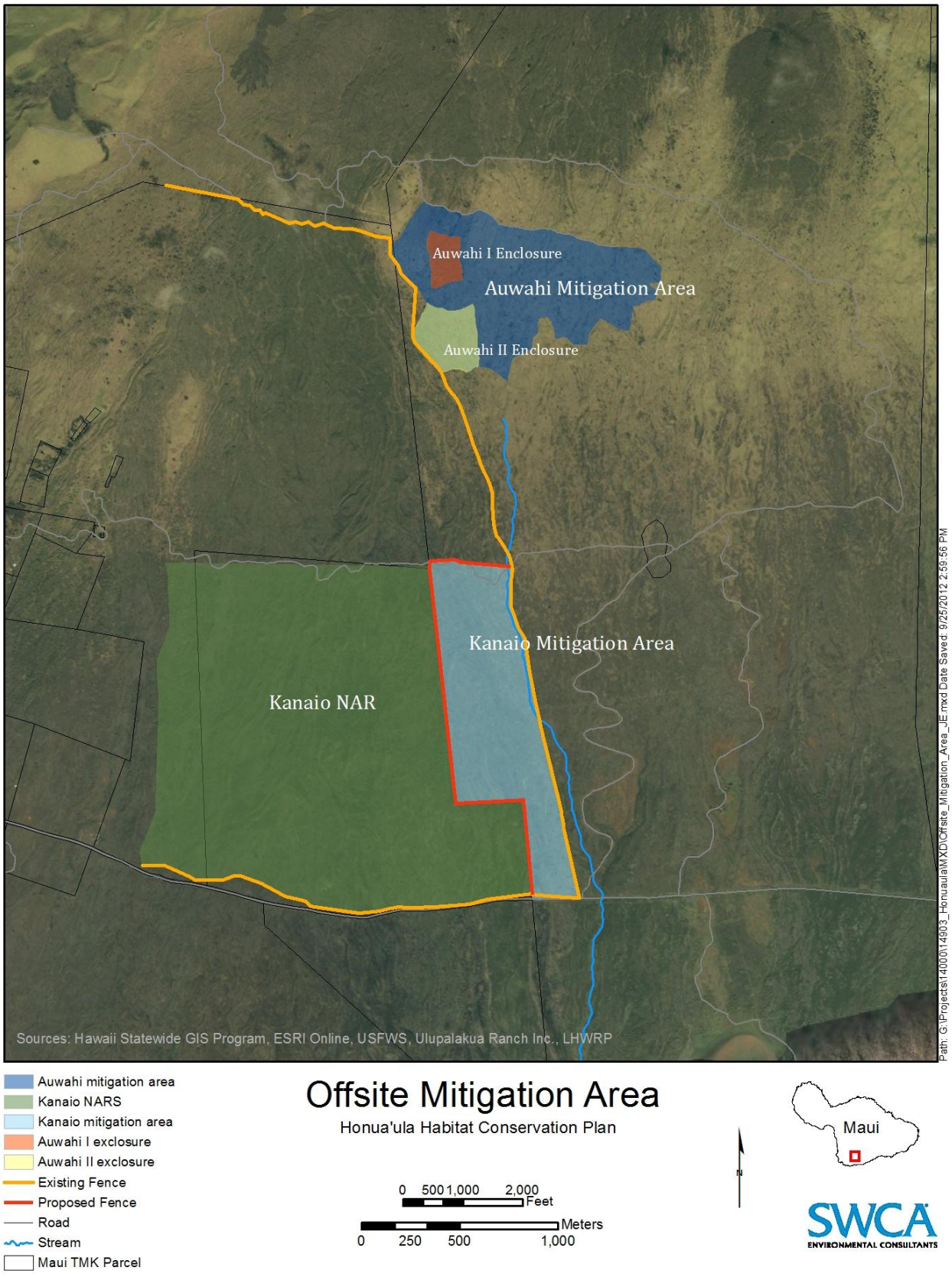
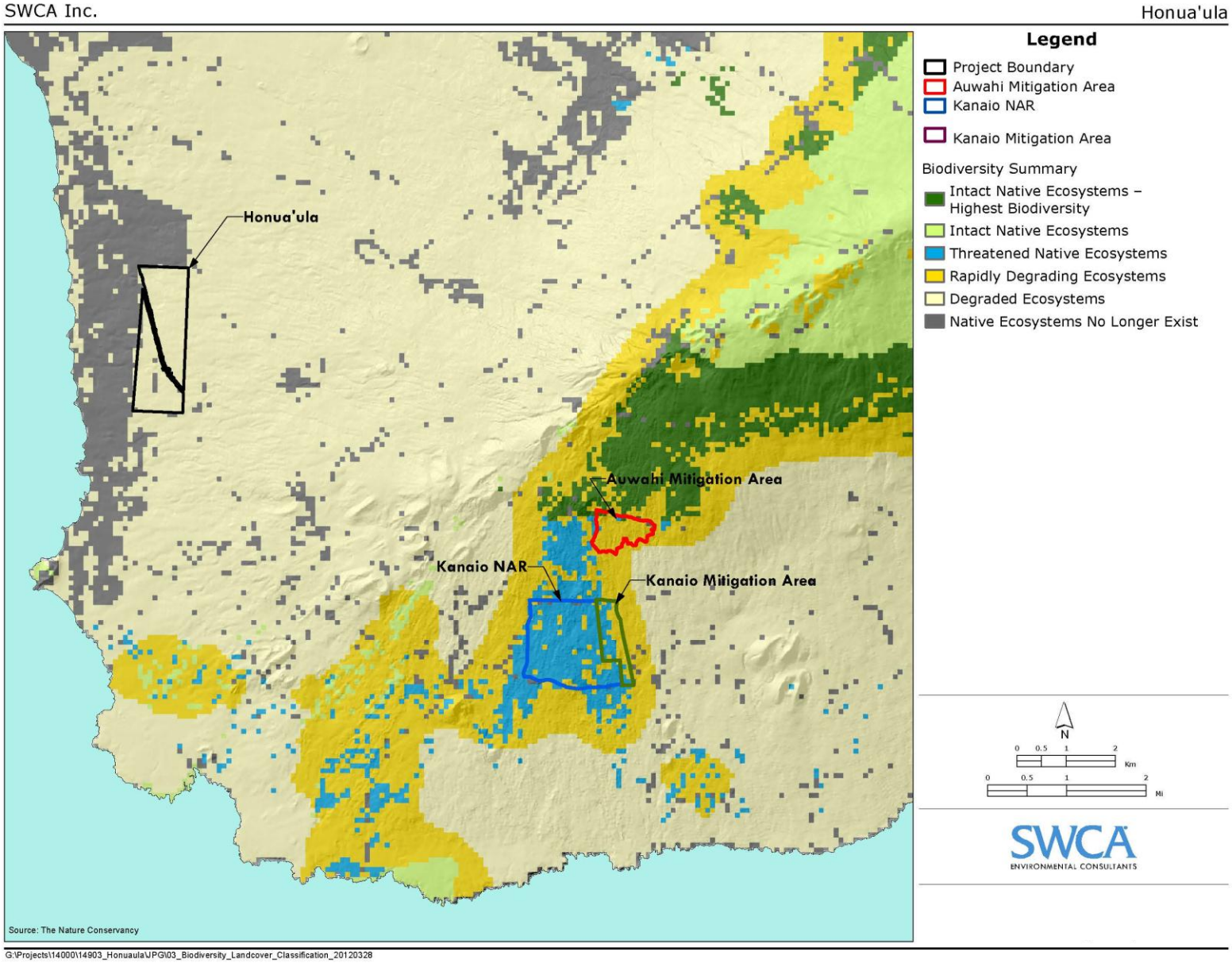


Figure 7.2: TNC Biodiversity Landcover Classification



7.5 Nēnē

The nēnē mitigation described below was developed with the intention of providing a net ecological benefit to the species in alignment with state and federal species recovery goals. Honuaʻula Partners, LLC will provide support for nēnē population protection and enhancement or nēnē propagation and release, which may include translocation.

The estimated cost for each proposed measure is presented in Appendix 9. All proposed measures are intended to promote the recovery of the species within portions of its historic range.

7.5.1 Nēnē Mitigation

Mitigation for nēnē will take into account the expected direct and indirect take of the species for the life of the project, as well as any loss of productivity that might occur. Mitigation for any direct take of adults and direct or indirect take of goslings or fledglings will be provided through replacement by adults and possibly fledglings. However, when adults are replaced by fledglings, the survival rate of fledglings to adulthood will be taken into account in determining the number of fledglings needed to offset expected levels of take of adult birds.

In addition, because female nēnē mature at age three and males at age two (Banko et al. 1999), the proposed mitigation will also need to account for possible loss of reproduction during the lag years between take of adult birds and the sexual maturity of fledglings with which they are replaced. For the purposes of this HCP the take of a mature female will require accounting for two years of possible lost productivity (an adult lost in Year 1 would be replaced by fledglings in Year 1, with indirect take separately accounted for, no gosling production would occur in Year 2 and 3 because the birds released in Year 1 are still immature; in Year 4 the now adult female released as a gosling in Year 1 could begin reproducing). Only one year of productivity loss will be attributed for the take of a mature male. However, if mitigation results in production of mature nēnē prior to actual incidental take under the ITL/ITP, loss of productivity will not be assessed, essentially lowering the required number of fledglings.

Average loss of productivity through mortality of one adult has been determined to be 0.09 goslings/individual/year (see Section 6.1.4). The mortality rate of captive-reared released goslings to Year 1 was reported to be 16.8% for females and 3% for males (Hu 1998; Banko et al. 1999). For the purposes of this HCP, an annual mortality rate of 17% is assumed to occur for both genders of geese through maturity (age two or three depending on gender). Male and female nēnē are assumed to be equally vulnerable to potential take associated with golf course activities. Table 7-1 identifies the number of fledglings that will be required to be released to offset the level of take anticipated for nēnē during post-build out phase of the project. All take will be replaced with fledglings within the same year or earlier. If increased adult survival can be demonstrated, the estimate can be adjusted accordingly.

Based on a take estimate of four adults and one fledgling over the project life, eight fledglings or five adults will be required as compensation for the requested take.

The proposed mitigation measures for nēnē consist of the following alternatives:

- First, Honuaʻula Partners, LLC proposes to contribute $40,000 to the rehabilitation of nēnē that would otherwise have been removed from the population, and that are released back into the wild. An annual contribution of $5000 will be made for the operating cost of the Hawaii Wildlife Center for five years, in addition to payment of $3000 per bird for the rehabilitation and release of five nēnē. The annual contribution ensures that the facility remains operational for the admittance and rehabilitation of nēnē, and the per bird fee will cover the direct rehabilitation cost of the individual birds. It is anticipated that at a rate of one bird per year, the mitigation requirements will have been met in five years. Contributions to the Hawaii Wildlife Center will be made no later than upon completion of the golf course at the Property, which is anticipated two years after initiation of Phase I construction. The Hawaii Wildlife Center, located in Kapaʻau on the island of Hawaiʻi, is currently the only center with the

facilities, and expertise to provide services of capture, treatment, recovery, and release of native Hawaiian wildlife including nēnē. Their expert services are outlined in Appendix 5.

- Alternatively the proposed mitigation measures may consist of providing funding of $30,000 to DLNR upon completion of the Honuaʻula golf course for the propagation and release of a total of eight goslings over a three year period. This includes funding toward staffing operations, maintenance, and predator control at the nēnē release facility, and helicopter operations to transport goslings to the release site. These goslings are to be released at a release pen in order to establish a new self-sustaining population on Maui Nui (Maui, Molokaʻi, Lānaʻi, and Kahoʻolawe) as recommended in the nēnē recovery plan (USFWS 2004).

Table 7-1: Mitigation required for nēnē assuming same year replacement.

	Direct take		**Indirect take**	**Total fledglings required**
	Male	**Female**	**Fledglings**	
Total requested take for project life	2	2	1	
Fledglings required	2.9 (=2/0.83/0.83)	3.5 (=2/0.83/0.83/0.83)	1	7.4
Loss of productivity	0.18 (=2 x 0.09 x1 year)	0.36 (=2 x 0.09 x 2 years)		0.5
Grand total for life of project				**7.9**

This calculation for required mitigation uses a 16.8 annual mortality rate for captive-reared females a 9% annual mortality rate for captive-reared males, and an annual loss of productivity of 0.09 individuals per adult. Total estimated direct take is three nēnē for the project life.

- The cost of nēnē gosling production is based on an estimate of $75,000 per year required to run the nēnē breeding facility, with an annual production of 25 goslings. Adults or family groups may also be translocated from Kauaʻi and released at the pen to serve as founders of a new population. Eggs may also be obtained from Kauaʻi and the goslings hatched at the breeding facility for release at the pen. Funding may also be used to maintain or modify the existing quarantine facility to accommodate the species. Goslings are released at around 10 weeks of age, and are close to or at the point of fledgling. Barring health issues, all goslings introduced into the release pen are expected to fledge, thus each gosling released counts towards mitigation. The release will occur at a suitable off-site release pen on Maui as decided with concurrence of USFWS and DLNR. An appropriate release site would be identified in consultation with USFWS and DLNR.

- Currently the captive rearing and release program has been put on hold and resources have been shifted to the translocation of nēnē from Kauai. Therefore, upon recommendation by DLNR, rehabilitation is being proposed as the primary mitigation measure. However, per USFWS recommendation, other alternative mitigation measures may be implemented, including the following:

    - Contribution of funds within the range proposed above for predator control at the Haleakala Ranch release site to help ensure that the birds released at this site successfully establish a population.
    - Contribution of funds within the range proposed above for a rescue pen at Haleakala National Park to support egg and gosling rescue.
    - Contribution of funds within the range proposed above for the purchase of radio transmitters and receivers or satellite transmitters, and/or staff time to support monitoring on nēnē on Maui.
    - Contribution of funds within the range proposed above to support public outreach and education at Haleakala National Park to reduce nēnē mortality at nest sites located within public areas, where nēnē nesting success is particularly low.

- Funding and implementation of the Nēnē mitigation measures will commence upon completion of the golf course, which is projected at two years after start of Phase I construction.

7.5.2 Measures of Success

Mitigation for nēnē will be deemed successful if the mitigation efforts result in one more adults or fledglings than that required to compensate for the requested take. Extra benefit will be derived from the annual funding for five years of ongoing operations at the Hawaii Wildlife Center. If goslings are reared and released at a release facility, all adults taken will be replaced by goslings. The mitigation will be deemed successful if the number of goslings that fledge at the pen due to releases or increases in reproductive success due to management exceed the requested take number.

Success of mitigation measures may be measured by an increase in adult or juvenile survival or increased productivity (average number of fledglings per pair) at the release site over baseline levels. In this case, a taken adult may be replaced through increased survival rates of adults in the area or adults may be replaced by goslings. The number of fledglings produced will be the result of the difference in productivity before (baseline) and after the implementation of predator trapping area multiplied by the number of nesting pairs estimated to be within the mitigation area. The number of adults saved from predation will consist of the difference in adult survival rates before (baseline) and after the implementation of predator trapping, multiplied by the estimated number of adults within the mitigation area. Baseline levels will be obtained from a mitigation site with existing baseline data, or based on best available scientific data from other representative sites.

If results of mitigation efforts at the release site do not exceed the baseline productivity or adult survival rates for two years of implementation (to take into account possible annual variations), then adaptive management measures will be implemented. The magnitude and scope of these measures will be determined by the Applicant and approved by USFWS and DLNR based upon monitoring and best available scientific information.

For alternative mitigation measures as directed by DLNR or FWS, for which quantitative success cannot be measured, mitigation will be considered successful if measures have been carried out as described and/or as agreed upon with DLNR and FWS.

8 IMPLEMENTATION

8.1 HCP Administration

This HCP will be administered by Honuaʻula Partners, LLC with guidance from the USFWS and DLNR. Other experts may be consulted as needed, including biologists from other agencies (e.g., U. S. Geological Survey), conservation organizations, consultants and academia. HCP-related issues may also be brought before the ESRC for formal consideration when deemed appropriate by Honuaʻula Partners, LLC, USFWS or DLNR.

Honuaʻula Partners, LLC will meet at least annually with USFWS and DLNR. Additional meetings and conferences may be called by any of the parties at any time to address immediate concerns. The purpose of the regular meetings will be to evaluate the efficacy of monitoring methods, compare the results of monitoring to the estimated take, evaluate the success of mitigation, and develop recommendations for future monitoring and mitigation. Regular meetings will also provide opportunities to consider the need for adaptive management measures. In addition, Honuaʻula Partners, LLC will meet annually with the ESRC to provide updates of monitoring, mitigation, and adaptive management, and to solicit input and recommendations for future efforts. Additional meetings may be requested by the ESRC at any time to address immediate questions or concerns.

8.2 Monitoring and Reporting

The monitoring program within this HCP will address both monitoring of impacts, and tracking of success of mitigation measures. All monitoring activities onsite and offsite will be coordinated by the Natural Resources Manager, with the aid of trained staff as appropriate. The monitoring of impacts associated with the construction of the site is closely linked to the surveys designed to minimize or avoid these impacts. This onsite construction monitoring includes:

- Pre-construction wildlife surveys. If covered or other listed wildlife is found within the construction area, the area will be treated as described in Chapter 7, and monitored until listed wildlife is no longer present.
- Fences constructed around natural areas, including the Native Plant Preservation Area, will be inspected regularly and any impacts to the vegetation and wildlife within will be monitored and reported.
- All potential larval host plants for the Blackburn's sphinx moth will be checked for presence of larvae or eggs as described in section 7.1.1.13. Occupied host plants will be monitored and treated as described in 7.1.1.13.

Post construction monitoring of impacts on listed species will include:

- Daily monitoring of the golf course for presence of nēnē and other listed species. Presence of listed species on the golf course will be handled as described in section 7.1.1.11. Any impacts to listed species on the golf course will be reported according to section 7.1.1.11 and appendix 7.
- Personnel, including security personnel, will be trained to look for and recognize listed species covered in the HCP, including Blackburn's sphinx moth, Hawaiian petrel and Newell's shearwater. This will ensure ongoing monitoring of the property, particularly the most brightly lit areas, for potential fallout of listed species.
- A sub sample of lights within a half-mile radius from the Native Plant Preserve Area will be checked for downed Blackburn's sphinx moths on a weekly basis. Any Blackburn's sphinx moths found on the Property will be reported according to section 7.1.1.11 and appendix 7.

Monitoring will be an integral part of this plan to ensure that mitigation goals will be met. This will include monitoring of both onsite and offsite mitigation areas.

- Integrity of fences will be inspected on a quarterly basis.
- The onsite and offsite mitigation areas will be monitored at least of quarterly for the presence of ungulates.

- Success of rodent population suppression at the onsite Native Plant Preservation Area will be monitored at regular intervals using traps and/or tracking tunnels.
- Percent cover of non-native weeds will be monitored on an annual basis.
- Long-term monitoring of mitigation success includes:
    - Blackburn's sphinx moth presence and abundance,
    - Survival and the relative number of host plants,
    - Presence of additional threats to Blackburn's sphinx moth, including ants, and trichogramma wasps.

Other specific measures may be added to the monitoring plan as per recommendation of DLNR or USFWS.

Honuaʻula Partners, LLC will provide annual reports to DLNR and USFWS by August 31 of each year. Honua'ula Partners, LLC will confer with USFWS and DOFAW following the submittal of the annual report to review the results and discuss future HCP implementation issues. These reports will include information on realized take, implementation and success of avoidance, minimization, and mitigation measures as described in this HCP, and other information as requested by the agencies.

Pursuant to chapter 195D HRS, DOFAW may conduct independent monitoring tasks during the life of the permit to ensure compliance with the terms and conditions of the HCP and ITL, and all costs associated with compliance monitoring shall be paid by the applicant.

8.3 Adaptive Management

According to USFWS policy (see 65 Fed. Reg. 35242 [June 1, 2000]), adaptive management is defined as a formal, structured approach to dealing with uncertainty in natural resources management, using the experience of management and the results of research as an on-going feedback loop for continuous improvement. Adaptive approaches to management recognize that the answers to all management questions are not known and that the information necessary to formulate answers is often unavailable. Adaptive management also includes, by definition, a commitment to change management practices when determined appropriate for the benefit of the Covered Species.

The adaptive management program for this HCP addresses any uncertainties in achieving mitigation goals for the Covered Species. For the most part mitigation practices as described in this HCP are not expected to require much adaptive management. However, monitoring of implementation and success of minimization and mitigation measures may lead to implementation of adaptive management. This includes the following measures:

- It is uncertain if and how many nēnē will become attracted to and established on the golf course that is proposed to be part of the development of the Property. The proposed minimization measures have been designed based on best available information at the time of writing. If, despite these minimization measures, take does occur at a higher rate than accounted for in this HCP, Honuaʻula Partners, LLC will consult with DLNR and USFWS about design and implementation of additional or alternative minimization and mitigation measures.
- The mitigation measures to compensate nēnē take are expected to be successful within the timeline specified for the measure. If mitigation cannot be accomplished using that measure within the specified timeline, more time may be allotted or alternative mitigation measures may be initiated.
- Ungulate removal from the fenced areas is expected to occur within the timeline specified in this HCP. However, due to challenges posed by terrain or vegetation, additional time or resources may be necessary to effectively remove ungulates from the mitigation areas.
- USFWS and DOFAW may decide to direct Honuaʻula Partners, LLC to remove tree tobacco from the Native Plant Preservation Area. It may be considered an attractive nuisance should take of Blackburn's sphinx moth be documented on site. Tree tobacco will only be removed from the Native Plant Preservation with approval from USFWS and DOFAW, and in accordance with USFWS tree tobacco removal guidelines.

- Although a perimeter fence for Kanaio has been funded by USFWS, at this time the fence has not yet been completed. Should the fence be completed and ungulates be removed from Kanaio NAR within two years after initiation of Phase I construction at the Property, the installation of the new section of ungulate fence between the Kanaio mitigation parcel and Kanaio NAR will not be necessary to help protect the area from ungulates. In this scenario funds allocated to the new fence construction may be used for alternative measures, which will be identified with the approval of USFWS and DOFAW, to benefit the Blackburn's sphinx moth and the system on which it depends at the mitigation parcel.
- Offsite mitigation will take place within the Kanaio and Auwahi areas, where it is most likely to have the maximum conservation benefit, subject to landowner and agency approval. It is possible that the exact area description or boundaries of these areas may differ from those indicated on the maps included in this HCP as a result of discussion with ESRC and the landowners. The mitigation will occur within the Kanaio and Auwahi areas, and the total acreage will be as indicated in this HCP.
- The USFWS protocol to minimize and avoid impacts to the Blackburn's sphinx moth (Appendix 11) will be used during construction, and these protocols are expected to be updated as new information may become available. Updated protocols will be used when appropriate.
- Size and specifics of fire breaks may be adapted if new information supporting alternative specifics becomes available.

Further adaptive measures are not anticipated for the measures described in this HCP. However, after review of the annual monitoring report and in consultation with DLNR and USFWS Honuaʻula Partners, LLC may implement adaptive management changes to the avoidance, minimization, and mitigation measures described in this HCP. Furthermore, if new information becomes available during the life of the permit, this may be used to further improve effectiveness of the measures in this HCP.

8.4 Funding Plan

Consistent with Section 10 of the Federal Endangered Species Act and Chapter 195D of the Hawaiʻi Revised Statutes, this funding plan has been designed to ensure that all the identified mitigation and conservation actions and their associated costs will be funded

Prior sections of this HCP describe a habitat conservation program with measures that Honuaʻula Partners, LLC will undertake to monitor, minimize, and mitigate the incidental take of each covered species, plus provide a net conservation benefit, as measured in biological terms pursuant to Chapter 195D, HRS. This section summarizes planning-level estimates of the costs to implement the conservation program, both during and after the permit term, as well as the proposed timing of the funding and the funding assurances. As described in the funding assurances section below, the developer will be responsible for covering all costs.

All cost estimates are derived/ summarized from the more detailed cost estimates provided in Appendix 9. Cost estimates are stated in constant 2012 dollar terms.

8.4.1 Habitat Mitigation Costs/ Investments

HCP implementation will require investments in habitat preservation, upfront habitat improvements, and on-going habitat management and monitoring, both during the permit term and after the permit term, as described below:

- Land Costs/ Conservation Easements. The HCP proposes an on-site preserve and two off-site mitigation preserves. The developer will secure and dedicate the necessary conservation easements on these areas.

- Upfront Land Improvements/ Investments. The on-site Native Plant Preservation Area and the Kanaio and Auwahi off-site mitigation will require extensive upfront investments in fencing, ungulate and animal removal, and fire breaks. These investments are expected to occur in the first two years of HCP implementation and total about $1.88 million (constant 2012 dollar terms).

- Management, Planning, Monitoring, Education, and Replacement. A number of additional, ongoing expenditures will be required on site management, preserve management, fencing replacement, and other tasks required to ensure the HCP conservation goals are met. During the permit term, from year 1 to year 15, these annual costs are estimated to range from $192,700 to $221,500, in 2012 dollar terms, and total $3.06 million.

- Post-Permit Endowment. Habitat management and monitoring will be required, in perpetuity, beyond the end of the permit term. An endowment sufficient to generate real interest payments (interest over and above inflation) that can cover these ongoing post-permit costs will be required. These ongoing costs are estimated at $191,000 annually. Under the endowment strategy described in the funding section below, an average, annual real interest rate of 3.25 percent is expected. This results in the need for a $5.88 million endowment at the end of the permit.

8.4.2 Funding Strategy

Summary of Funding Approach

The funding approach is based around the following four key components:

1. Direct developer funding of the majority of the mitigation requirements upfront, prior to initiation of Phase 1 construction.

2. Additional funding from secured sources during the permit term.

3. Full funding of the required post-permit endowment by the end of the permit term to fund all post permit mitigation requirements

4. Placement of the endowment funding in the endowment program of the National Fish and Wildlife Foundation (NFWF) or other entity approved by DOFAW and the USFWS prior to Permit issuance.

Funding by Cost Component

This funding approach includes the following approaches to funding the key cost components described above:

- Land Costs/ Conservation Easements. Full funding of the habitat preservation costs (placement of conservation easements over the on- and off-site preserves) prior to initiation of Phase 1 construction. The developer will directly fund and secure the habitat preservation.

- Upfront Land Improvements/ Investments. Funding of over 75 percent ($1.44 million) of the upfront land improvements/ investments prior to Phase 1 grading, with the remaining 25 percent ($440,000) occurring the year after receipt of the Phase 1 grading permit.

- Upfront Endowment Funding. An investment of $3.0 million in a NFWF or other entity approved by DOFAW and the USFWS prior to Permit issuance, endowment account prior to Phase 1 grading, representing over 50 percent of the full post-permit endowment of $5.88 million required (2012 dollars).

- Permit Term Habitat Management and Monitoring Funding. A property-wide annual assessment of an average of $200,000 each year, secured by a covenant between Honua'ula Partners and USFWS recorded against the land, will provide funding for the estimated $3.06 million (2012 dollars) permit-term habitat management and monitoring costs. This covenant will be in effect for the first 15 years of the permit term, but this term could be reduced if all mitigation requirements have been met.

- Additional Endowment Funding. The additional $2.9 million in endowment funding (beyond the starting balance) will be generated through the property-wide annual assessment and cumulative interest revenues. The property-wide annual assessment will be set to generate an additional $70,000 each year or $1.05 million by the end of the permit term (2012 dollars) These revenues will be paid each year directly into the endowment account, and together with the starting balance of $3.0 million, will generate cumulative interest payments. By the end of the first 15 years of the permit term, under the expected 3.25 percent real interest rate, a total of $1.9 million in interest revenues is expected. Together, the permit term assessment revenue and interest income will provide $2.95 million of additional endowment funding by the end of the permit term, totaling $5.95 million at the end of the permit term.

Endowment Placement and Returns

To ensure the appropriate management of the endowment funding, the developer will place all endowment funding with the NFWF Impact-Directed Environmental Accounts (IDEA) program. This program was established to manage endowments for conservation activities. NFWF staff have indicated that the expected, average annual net real interest rate (inflation and investment management costs removed) is in the 3.25 to 3.5 percent range. In other words, barring unexpected market swings, NFWF expects to be able to provide an average annual return of between 3.25 and 3.5 percent on the mitigation endowments it holds. The lower 3.25 percent rate of return has been applied in this analysis.

8.4.3 Funding Assurances

Upfront funding of the majority of mitigation costs will remove substantial uncertainty associated with the availability of funding. The developer understands that there will be two endowment sufficiency reviews, one directly prior to the start of Phase 2 grading and the second, directly prior to the start of Phase 3 grading. To the extent that ongoing habitat management and monitoring costs have been higher than expected or the NFWF indicates that a different real interest rate is appropriate, an adjustment to both the endowment funding requirement and the annual assessment will be established. To the extent that additional endowment funding is required, the developer will provide the additional funding prior to the end of the first 15 years of the permit term.

8.5 Changed Circumstances Provided for in the HCP

Circumstances change or occur during the life of an HCP, some of which can be anticipated and planned for. For Honuaʻula, possible changed circumstances that are anticipated and planned for include: 1) climate change; 2) disease outbreaks in any of the listed species; 3) deleterious change in relative abundance of non-native plant species; 4) hurricanes or other major storms that may affect the project area and/or mitigation sites; 5) changes in the price of raw materials and labor; 6) the de-listing of any species covered in the HCP; and 7) the listing of one or more species that already occur on-site, not currently covered in the HCP.

The procedures to provide for these scenarios are described below:

1) Global Climate Change Significantly and Negatively Alters Status of the Covered Species

   Global climate change within the life of the project (30 years) has some limited potential to alter the current distribution of vegetation communities utilized by the Covered Species through region-wide changes in weather patterns, sea level, average temperature and levels of precipitation (IPCC 2007). In some instances, climate change may cause populations of Covered Species to decline. Covered species are likely to be affected through changes in the distribution of their food resources and possible changes in the vegetation at their preferred nesting habitats. It is unknown how the Blackburn's sphinx moth will be affected by any changes in climate over the life of the Permit due to its presumed ability to utilize non-native habitats. The distribution of nēnē native food resources, particularly at high elevations, may change if climate change alters the range of native plants that they utilize. Nēnē, however, are also able to use a wide variety of non-native food resources.

   With climate change, hurricanes or storms may occur with greater intensity (Webster et al. 2005; U.S. Climate Change Science Program 2009), which may increase the risk of damage to established mitigation sites. This is discussed in Scenario 4 below. Sea level is predicted to rise approximately 1 m in Hawaiʻi by the end of the 21st Century (Fletcher 2009). Given this prediction, any rise in sea level experienced during the life of the project would likely be less than 3 feet (1 m). As mitigation sites are more than 3 feet above sea level, these sites are unlikely to be impacted by sea level rise during the project life.

   Precipitation may decline by 5-10 % in the wet season and increase 5% in the dry season, due to climate change (Giambelluca et al. 2009). This may result in altered hydrology at the mitigation site. Other mitigation sites may be considered for continued mitigation if the existing site is no longer considered suitable. The alternate mitigation site will be chosen in consultation with USFWS and DLNR.

   Vegetation at the mitigation site may also change with decreased precipitation or increased temperatures and wildfire threat. Although changes are expected to be small over the lifetime of the Permit, they are much less predictable in the long term. Should significant changes in vegetation be deemed to be occurring and be demonstrated to affect the productivity of the Covered Species, other mitigation sites may be considered for continued mitigation, if deemed necessary, and will be chosen in consultation with USFWS and DLNR. In all cases, mitigation efforts will remain commensurate with requested take with a net benefit provided to each Covered Species as required by State law.

   Any changes in the mitigation measures implemented for any of the Covered Species due to climate change will be performed to meet the objectives outlined in this document. Modifications to the endowment budget made during the first 15 years of Permit issuance will be made to, based on the best available information, incorporate anticipated project costs associated with a changing climate.

2) Disease Outbreaks in Covered Species

   Nēnē are not considered to be limited by disease, although omphalitis, an infection of the umbilical stump, has been found to cause mortality in both wild and captive nēnē goslings

(USFWS 2004a). These geese have also been documented to have been infected with avian pox and avian malaria, but no deaths have been attributed to either disease (USFWS 2004a). It is considered possible that the introduction of West Nile virus may affect the survival of nēnē (USFWS 2004a).

Should the prevalence of disease increase dramatically and become identified as a major threat to the survival of these species by DLNR and USFWS, Honuaʻula Partners, LLC will consult with DLNR and USFWS to determine if changes in monitoring, reporting or mitigation are necessary to provide assistance in documenting or reducing the impact of the disease whether the disease is or is not transmitted by humans or is due to human habitat modification.

Any changes prompted by disease outbreaks in the species covered in the HCP will be performed to achieve mitigation objectives. The endowment budget incorporates funding to enable mitigation objectives to be met in the event of disease outbreaks if mitigation actions have not been fully achieved or unmitigated take remains.

3) Deleterious change in relative abundance of non-native plant species, ungulates, parasites, or predators occurring at the mitigation sites for Covered Species.

Should the proportion or coverage of non-native plant species, parasites, or predators increase at any mitigation site to a point where it is believed that this change is causing significant habitat degradation or loss of habitat, or significant increases in mortality for the Covered Species, thereby resulting in a measurable decline of the species at the site, the Applicant will consult with DLNR and USFWS to determine if measures to prevent the further spread of non-native plants, parasites, or predators are available, practical and necessary. If no such measures are available, mitigation measures for the affected Covered Species may be implemented at another site as determined with DLNR and USFWS. Costs for implementing such measures and consequent changes in monitoring, reporting or mitigation as deemed appropriate by DLNR and USFWS have been incorporated into the mitigation budget in the HCP. These actions will be implemented if mitigation actions have not been fully achieved or unmitigated take remains.

4) Natural Disasters Such as Hurricanes and Severe Storms.

Natural disasters, including hurricanes and storms, have potential to significantly affect the status of one or more of the Covered Species on Maui and, consequently, alter the relative importance of the incidental take of individuals. Such disasters could also greatly hinder or disrupt mitigation efforts.

It is not known how nēnē respond to storms or hurricanes. Because nēnē are relatively sedentary, it is presumed likely that individuals of these species would seek available shelter rather than flee when confronted by major storms. The Applicant may implement changes in monitoring, reporting or mitigation to help population recovery or contribute to rehabilitation of habitat for nēnē following a major storm, if deemed appropriate by DLNR and USFWS. If no such measures are available, mitigation measures may be implemented at another site as determined with DLNR and USFWS. Any such measures and consequent changes in monitoring, reporting or mitigation as deemed appropriate by DLNR and USFWS will be implemented. The endowment budget incorporates funding to enable mitigation objectives to be met in the face of anticipated natural disasters if mitigation actions have not been fully achieved or unmitigated take remains.

It is not known how Blackburn's sphinx moths or their habitat respond to storms or hurricanes. However, Honuaʻula will implement changes in monitoring, reporting or mitigation deemed appropriate by DLNR and USFWS if necessary. The endowment budget incorporates funding to enable mitigation objectives to be met in the face of anticipated natural disasters if mitigation actions have not been fully achieved or unmitigated take remains.

5) Changes in the Price of Raw Materials and Labor

   Annual reviews will be performed to analyze the costs in the previous year's budget for mitigation expenses and cumulative costs. Annual expenses for subsequent years will be adjusted to meet projected costs based on previous years' expenditures and cumulative spend to date.

6) De-listing of Covered Species

   Should any of the species covered in the HCP be de-listed during the tenure of the permit, it is expected that the mitigation efforts provided by Honuaʻula would have contributed in some part to the de-listing of the species. Therefore, mitigation actions for that species will continue to be performed in accordance with the HCP, unless and until USFWS and DLNR agree that such actions may be discontinued.

7) Listing of One or More Species that Already Occur On-site

   In the event that one or more species that occur on-site are listed pursuant to the ESA, Honuaʻula Partners, LLC will evaluate the degree to which the species is (or are) at risk of being incidentally taken by project operations. If take of the species appears possible, Honuaʻula will then assess whether the mitigation measures already being implemented provide conservation benefits to the newly listed species and if any additional measures are needed to provide a net conservation benefit to the species. Honuaʻula Partners, LLC would then seek coverage for the newly listed species under an amendment to the HCP.

Potential remediation measures to address changed circumstances at the project area or mitigation site(s) are anticipated to improve the overall habitat quality and/or health of the Covered Species following recognition of a changed circumstance. However, these activities also have the potential to impact wildlife and their habitat. Potential impacts from the remediation measures are discussed in the HCP EA.

8.6 Changed Circumstances Not Provided for in the HCP

If changed circumstances occur that were not provided for, or much more severe than described in Section 8.5, and the HCP is otherwise being properly implemented, the USFWS and DLNR will not require any conservation and mitigation measures in addition to those provided for in the HCP without the consent of Honuaʻula Partners, LLC.

8.7 Unforeseen Circumstances and "No Surprises" Policy

Unforeseen circumstances are "changes in circumstance surrounding an HCP that were not or could not be anticipated by HCP participants, DLNR and USFWS that result in a substantial and adverse change in the status of a covered species" (USFWS and NMFS 1996). Under the "No Surprises" policy, with a properly implemented HCP (Hawaiʻi Revised Statues – Section 195D-23), Honuaʻula Partners, LLC will not be required to commit additional land, water, money or financial compensation, or be subject to additional restrictions on land, water or other natural resources to respond to such unforeseen circumstances beyond what has been already agreed upon in the HCP, without the consent of the applicant. For the purposes of this HCP, changes in circumstances not provided for in Section 8.4 that substantially alter the status of the Covered Species are considered unforeseen circumstances.

The "No Surprises" policy assurances only apply to species "adequately covered" in the HCP. Species considered to be "adequately covered" are those covered by the HCP that satisfy the permit issuance criteria under Hawaiʻi Statutes – Section 195D-21. The species considered adequately covered in this HCP, and therefore covered by the "No Surprises" policy assurances, include the nēnē and Blackburn's sphinx moth.

In the event that unforeseen circumstances occur during the term of the Permit and the USFWS and DLNR concludes that any of the Covered Species are being harmed as a result, the agencies

may require additional measures of the Permittee where the HCP is being properly implemented only if such measures are limited to modifications of the conservation program for the affected species and maintain the original terms of the HCP to the maximum extent possible. Additional conservation and mitigation measures will not involve the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water or other natural resources otherwise available for development or use under the original terms of the HCP without the consent of the applicant.

8.8 Notice of Unforeseen Circumstances

The USFWS and DLNR will have the burden of demonstrating that unforeseen circumstances exist, using best available scientific and commercial data. The USFWS and DLNR will notify Honuaʻula in writing should the USFWS or DLNR believe that any unforeseen circumstance has arisen.

8.9 Permit Duration

The HCP for Honuaʻula is written in anticipation of the issuance of an ITP and ITL to cover the entire project duration of 30 years. The ITL and ITP will be issued, or will take effect, upon initiation of phase I construction at which time anticipated covered activities will commence. This means the 30-year permit duration, and associated activities, will commence at the initiation of phase I construction.

8.10 Amendment Procedure

Different procedures are present that allow for the amendment to the ITL/ITP. However, the cumulative effect of any amendments must not jeopardize any listed species. USFWS and DLNR must be consulted on all proposed amendments and the amendment procedures are listed below.

8.10.1 Minor Amendments

Informal, minor amendments are permissible without a formal amendment process provided that the change(s) necessitating such amendment(s) does not cause a net adverse effect on any of the two Covered Species that is significantly different from the effects considered in the original HCP. Such informal amendments could include, but are not necessarily limited to, routine administrative revisions, changes to surveying or monitoring protocols that do not decrease the level of mitigation or increase take. A request for a minor amendment to the HCP may be made with written notice to USFWS and DLNR. A public review process may be required for the minor amendment. The amendment will be implemented upon receiving concurrence from the agencies.

8.10.2 Formal Amendments

Formal amendments are required when the Applicant wishes to significantly modify the project, activity or conservation program already in place. Formal amendments are required if the change(s) necessitating such amendment(s) could produce a net adverse effect on any of the Covered Species that is significantly different than any of those considered in the original HCP. For example, a formal amendment would be required if the documented level of take exceeds that covered by the HCP's adaptive management program. A formal amendment also would be required if another listed species is found to occur in the project area and could be adversely affected by project activities.

This HCP may be formally amended upon written notification to USFWS and DLNR with the same supporting information that was provided with the original application. The need for a formal amendment must be determined at least one year before permit expiration, as a formal amendment may require additional baseline surveys and data collection, additional or modified minimization and/or mitigation measures, and/or additional or modified monitoring protocols. It may also require a supplemental NEPA evaluation and additional public review.

8.11 Renewal and Extension

This HCP proposed by Honuaʻula Partners, LLC may be renewed or extended, and amended if necessary, beyond its initial 30-year term with the approval of USFWS and DLNR. A written request will be submitted to both agencies that will certify that the original information provided is still current and conditions unchanged or provide a description of relevant changes to the implementation of the HCP that will take place. Such a request shall be made at least 180 days prior to the conclusion of the permit term. Under Federal law, the HCP shall remain valid and in effect while the renewal or extension is being processed, but under State of Hawaiʻi law, the HCP will remain valid and in effect during processing only if the renewal or extension is processed during the original permit term. The permit may not be renewed for levels of take beyond those authorized by the original permit.

8.12 Other Measures

Issuance criteria under ESA section 10(a)(2)(B) authorize USFWS to obtain such other assurances as may be required that the HCP will be implemented. An Implementing Agreement stipulating the HCP's terms and conditions in contractual form will be signed by all parties (Honuaʻula, USFWS and DLNR).

9 CONCLUSION

Honuaʻula Partners, LLC looks forward to working with the USFWS, DLNR and the ESRC throughout the approval and long-term implementation of the HCP for the Honuaʻula project. While the construction of Honuaʻula will aid with closing the gap between demand and availability of housing for a variety of consumer types, construction of the community is not without potential for adverse and unavoidable environmental impacts. Honuaʻula Partners, LLC is committed to making all reasonable efforts to avoid, minimize, mitigate and compensate for these impacts as evaluated and determined through the HCP process and its adaptive management strategy to provide a net benefit to the species identified in the HCP through a transparent and consultative process with all parties concerned.

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Appendix 1

Appendix 1

BOTANICAL SURVEY OF HONUAʻULA (WAILEA 670), KĪHEI, MAUI

PREPARED FOR

Honuaʻula Partners, LLC
381 Huku Liʻi Place, Suite 202
Kīhei, Maui 96753

PREPARED BY

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201 Merchant St, Suite 2310
Honolulu, HI. 96813

August 2008
Updated January 2010

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1.0 INTRODUCTION

1.1 Objectives

SWCA Environmental Consultants (SWCA) was tasked to conduct a botanical survey within the 271 ha (670 ac) Honua'ula (Wailea 670) Property (hereinafter referred to as the 'Property') in Kīhei, Maui. The objectives of the survey were to: 1) describe the vegetation on the Property; 2) document all the plant species found on the Property; and 3) identify and map the location(s) of native plants. This report documents the results of the botanical survey, offers conservation management recommendations, and provides mitigation alternatives to address the Phase I project district zoning conditions promulgated by the Maui County Council. The survey also supports the Environmental Impact Statement (EIS) being prepared for the project by PBR Hawaii, Inc. in accordance with Chapter 343 Hawaii Revised Statutes (HRS). A companion document addressing wildlife and plant-related wildlife issues was prepared by SWCA and is submitted under separate cover (SWCA 2009a). Further documentation will detail the conservation and stewardship plan for the Native Plant Preservation Area and an animal management plan as required by the Maui County Council (SWCA 2009b).

Botanical surveys conducted in support of EIS and environmental assessments (EA) under HRS Chapter 343 are typically qualitative descriptions of vegetation and lists of species observed during brief pedestrian surveys. They are characteristically limited to a single survey rather than repeated seasonal assessments, and rarely the result of rigorous, quantitative research. In the past, greater emphasis was placed upon individual species than the ecosystems in which they occurred. To better address concerns raised by the Maui County Council and members of the public over the presence of native plants within the southern portion of the Property, SWCA set out to conduct a thorough quantitative assessment of site vegetation in order to obtain the best possible understanding of vegetation types and plant species present within the Property.

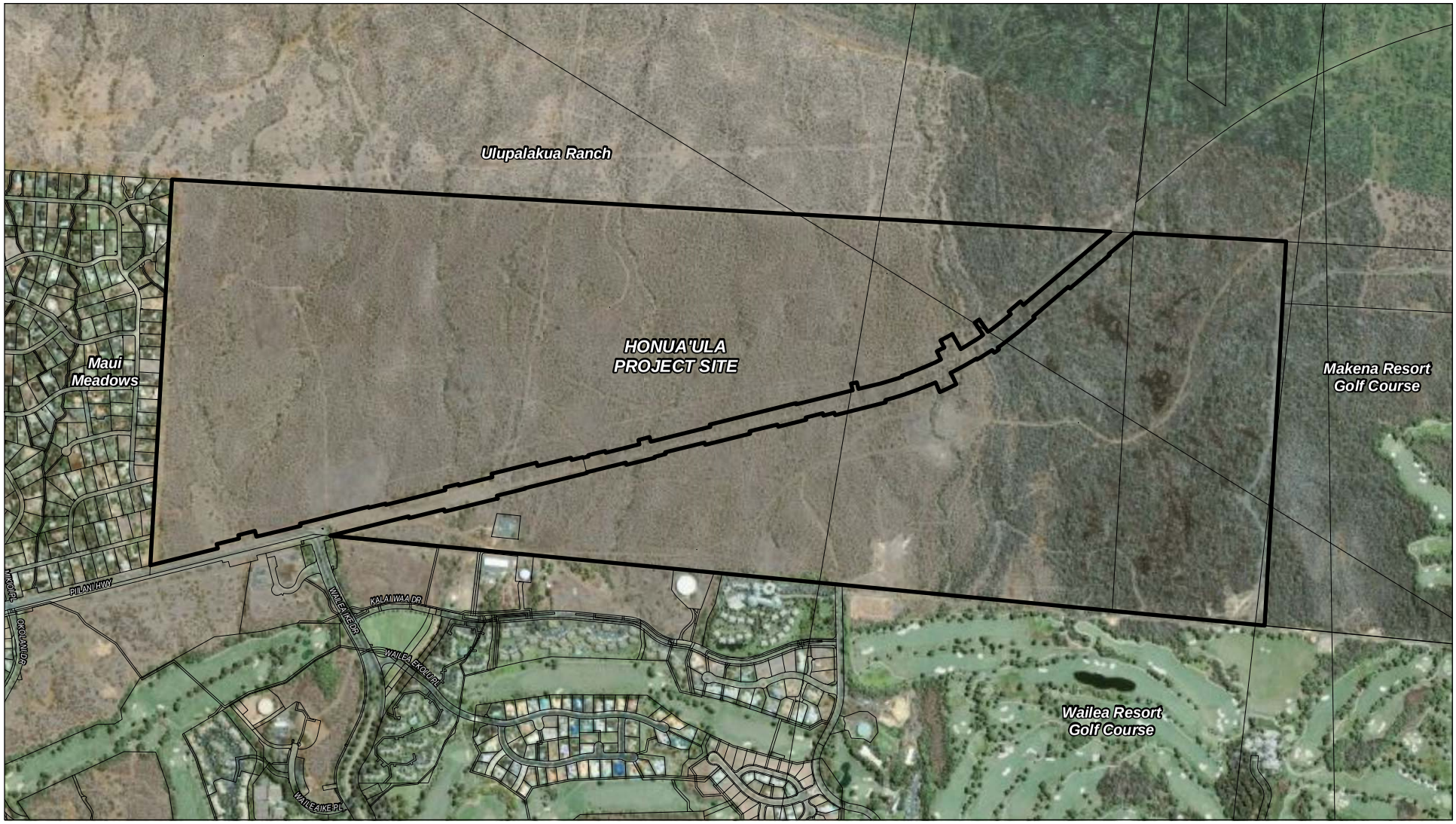
1.2 Project Summary

Honua'ula is a planned mixed-residential community encompassing a rectangular area of 271 ha (670 ac) east of, and adjacent to, the existing Wailea Resort in Kīhei, Maui. It is bounded by the Maui Meadows subdivision to the north, the Makena golf course to the south, the Wailea golf course to the west, and the 'Ulupalakua Ranch to the east (Figure 1). An EIS was first published for the development (then known as Wailea 670) in 1988 (PBR Hawaii 1988). Project district zoning was approved for the entire 271 ha in 1993, and approximately 170 ha (420 ac) was approved for golf course development and accessory uses. The following year, the State Land Use Commission issued a decision and order on urban land use designation. Since 1988, the project has had several owners.

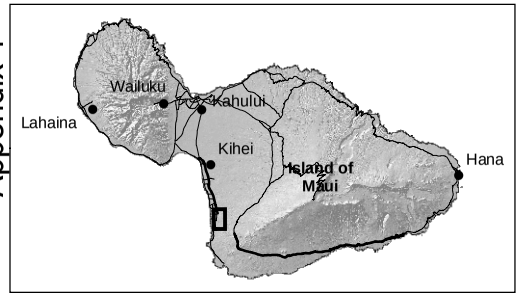
After six years of project revisions by the present owner to accommodate community concerns, the Maui County Council approved Phase I conditional Project District Zoning for 271 ha allowing for residential, limited commercial, golf course, and open space zoning. With this approval, the Maui County Council issued several conditions regarding the conservation of natural resources. Their conditions included the creation of a Native Plant Preservation Area and stewardship plan for the propagation of native dry land forest plants within the Property. The conservation and stewardship plan (SWCA 2009b) incorporates findings, conclusions, and recommendations of this report and a sister report prepared by SWCA on the wildlife resources of the Property.

1.3 Physical Setting

Approximately 200 ha (495 ac) of land in the northern three-quarters of the Honua'ula Property within the Paeahu ahupua'a consists of older lava flows of the Kula Volcanic Series (Figure 2). Older Kula lavas range in age from 140,000 to 950,000 years old, while younger Kula lavas in the central portion of the parcel may be between 13,000 and 30,000 years old (USGS). Weathering of lavas led to the formation of a thin layer of soil over the northern portion. About 70 ha (173 ac) of younger Hana Volcanic Series flows within the Palauea ahupua'a make up the southern quarter of the Property. The southern lava flows are estimated to be between 5,000 and 13,000 years old (Figure 2) and have not undergone extensive weathering.



Appendix 1



Legend

Honua'ula Project Boundary

TMK Parcels

Aerial Source: Microsoft 2009
Boundary and Parcel Source: PBR Hawaii

Figure 1
Aerial Photograph

0 250 500 1,000 ft

0 50 100 200 M

N

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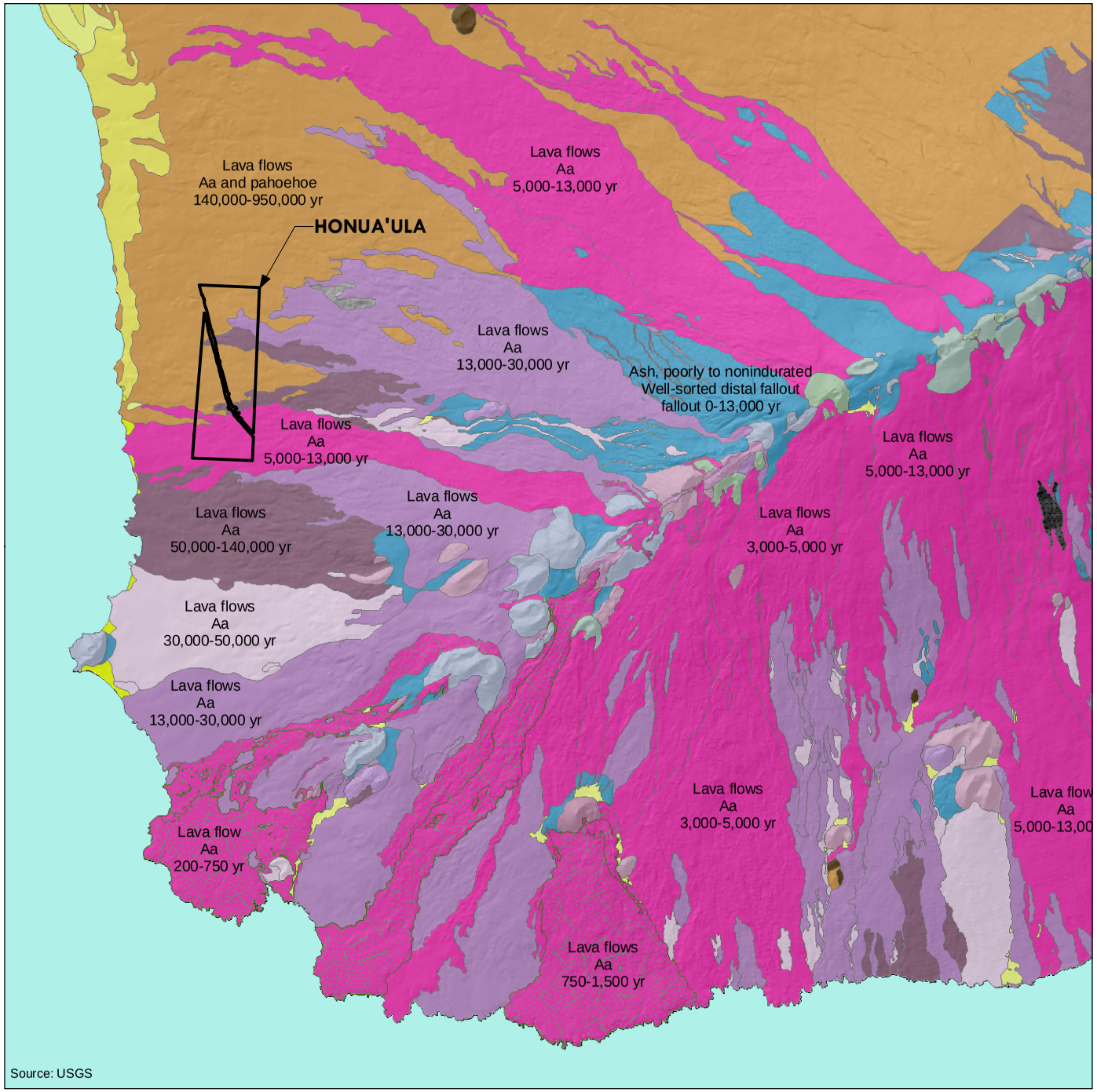

Legend

Project Boundary

Geology

- Qa, Alluvium
- Qbd, Beach deposits
- Qdy, Younger dune deposits
- Qhn, Hana Volcanics
- Qhn0, Hana Volcanics
- Qhn1, Hana Volcanics
- Qhn2, Hana Volcanics
- Qhn2v, Hana Volcanics
- Qhn3, Hana Volcanics
- Qhn6, Hana Volcanics
- Qhne, Hana Volcanics
- Qhnt, Hana Volcanics
- Qhnv0, Hana Volcanics
- Qhnv1, Hana Volcanics
- Qhnv2, Hana Volcanics
- Qhnv3, Hana Volcanics
- Qhnv4, Hana Volcanics
- Qhnv5, Hana Volcanics
- Qhnv6, Hana Volcanics
- Qkui, Kula Volcanics
- Qkul, Kula Volcanics
- Qkul?, Kula Volcanics
- Qkuls, Kula Volcanics
- Qkuv, Kula Volcanics
- Qkuv?, Kula Volcanics
- Qls, Landslide deposits
- Qtc, Talus and colluvium

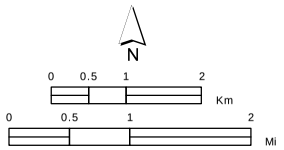

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Figure 2
Geology Map

Appendix 1

This area is characterized by an extremely rough surface composed of broken ʻaʻā lava blocks called clinker with little or no soil accumulation (PBR Hawaii 1988). The terrain slopes gently at about 12% in an east to west direction across the Property. Steeply sloping ridges and gulches dissect the parcel, particularly in the north. The soils and lavas covering the Property, and the drainage gulches that run across the land, strongly influence the nature of the vegetation that grows there.

1.4 Literature Review

At one time, Rock (1913) suggested that lowland dry and mesic forests in Hawaiʻi had more native tree species than any other area in the state. Since then, however, native lowland dry forests have been degraded by non-native herbivores and invaded by alien shrubs and grasses (Wagner, et al. 1999). True native dry forests are acknowledged to be the rarest native plant community within the main Hawaiian Islands (Bruegmann 1996) and the nation (Noss and Peters 1995). Bruegmann (1996) estimated that over 90 percent of Hawaiʻi's native dry forest habitats have been severely fragmented and degraded. Williams (1990) and Cabin et al. (2000a, 2000b) summarized the causative factors of this loss citing pre-contact fire and deforestation, non-native ungulate grazing, alien species invasions, and conversion of forests for agricultural, urban, and military uses.

During the Second World War, the military used lands in Kīhei for training and maneuvers (P. Erdman, Ulupalakua Ranch, pers. comm.). Activities within and adjacent to the Property included a Navy Underwater Demolition Team (UDT) training base at Kamaole, an Army camp at Makena, and amphibious assault training exercises by the Marine Corps. Jeep roads were bulldozed inland and cross-country movement by armored vehicles and troops were conducted. Following 1945, the area was returned to open pasture. Periodic bulldozing of the highway easement connecting Kīhei to ʻUlupalakua by the State of Hawaiʻi, grazing pressure from axis deer (*Axis axis*) and feral goats (*Capra hircus*), and unauthorized *kiawe* (*Prosopis pallida*) logging have caused further disturbance to the area.

Char and Linney (1988) conducted the first botanical survey within the Property area. They observed 132 plant species in three distinct vegetation types: *kiawe* (*Prosopis pallida*)/buffelgrass (*Cenchrus ciliaris*) pasturelands, gully vegetation, and scrub vegetation. Twenty-one of the 132 plant species they observed are native to Hawaiʻi. The remaining 111 are non-native species. They found no threatened or endangered plant species within the Property. However, they identified one candidate species, *ʻāwikiwiki* (*Canavalia pubescens*), and several uncommon native species on the site including *nehe* (*Lipochaeta rockii*), *ʻānunu* vine (*Sicyos hispidus*), *maiapilo* (*Capparis sandwichiana*), and *kolomona* (*Senna gaudichaudii*). Char and Linney (1988) recommended that a small area in the southwestern corner of the Property where they found *ʻāwikiwiki* (*C. pubescens*) and representatives of other uncommon native plants be left intact. However, sometime prior to 1996, unknown persons bulldozed the area and the plants were lost.

The *nehe* plants (*Lipochaeta rockii*) reported from the Property have a distinct leaf shape (A.C. Medeiros, USGS, pers. comm.); however, the current Manual of Flowering Plants of Hawaii (Wagner et al. 1999) did not find sufficient scientific evidence to recognize it as a distinct variety or subspecies. Herbst (Bishop Museum, pers. comm.) suggested that it might easily hybridize with other plants of the same species.

Recently, Altenberg (2007) drew attention to the southern portion of the Property which he claimed to be among the best examples of a remnant native lowland dry forest remaining on Maui. He suggested that Honua'ula "contains most of the 3rd largest contiguous area of *wiliwili* (*Erythrina sandwicensis*) habitat on Maui, approximately 110 acres in the southern 1/6 of the property" (Altenberg 2007). Altenberg recommended that an area of approximately 45 ha (110 ac) be preserved for its ecological significance. He found 20 native plant species (including 12 endemic species) concentrated in the southern one third of the Property. Four of the native species he observed - *pua kala* (*Argemone glauca*), *alena* (*Boerhavia herbstii*), *ʻakoko* (*Chamaecyse celastroides* var*. lorifolia*), and *ʻānunu* (*Sicyos pachycarpus*) - had not been reported by Char and Linney (1988) or Char (1993, 2004). Char and Linney (1988) and Char (1993, 2004) reported five species within the Property that were not found by Altenberg (2007): maidenhair fern (*Adiantum capillus-veneris*), *pellaea* (*Pellaea ternifolia*), *kakonakona* (*Panicum torridum*), *Solanum americanum* (*popolo*) and *alena* (*Boerhavia repens*).

Gagne and Cuddihy (1999) noted that native dry forest communities occur on all of the main islands at 300-1,500 m (984-4,921 ft) in elevation, especially on leeward aspects or in the rain shadows of mountains. Precipitation is between 500-2,000 mm (17-79 in) annually, and is usually concentrated between November and March. Gagne and Cuddihy (1999) noted that lowland dry forests usually "grade into lowland dry grasslands or shrub lands below 300 m elevation…" The semi-arid Honua'ula Property lies between 90-245 m (295-804 ft) elevation, and is estimated to receive about 300 mm (12 in) of precipitation annually. Hence, the southern portion of the Property may be described more accurately as a highly disturbed, remnant native coastal dry shrubland (sensu Gagne and Cuddihy 1999) in which *wiliwili* (*Erythrina sandwicensis*) has become a common inhabitant. Medeiros (USGS, pers. comm.) suggested that mature *wiliwili* (*Erythrina sandwicensis*) trees may be found throughout southeastern Maui, often in abundance and greater densities than those encountered in the Property. Altenberg (2007) identified eight *wiliwili* (*E. sandwicensis*) forests in southeast Maui including Kanaio, Pu'u o Kali, Honua'ula / Wailea 670, Makena, La Perouse, Kaupo, Lualailua, and Waikapu.

The recent US Geological Survey GAP Analysis Program (Figure 3) maps classified landcover within the Property as largely "XT: open kiawe forest and shrubland (alien grasses)", "Y: uncharacterized open-sparse vegetation", with small patches of "XG: alien grassland" and "XT: alien forest". Price et al. (2007) recently developed methods using bioclimatic data to map habitat quality for and range of two widespread plant species including *wiliwili* (*Erythrina sandwicensis*) and two rare plant species throughout the Hawaiian Islands. The area encompassed by the Property appears on these maps as 'medium' to 'low' habitat quality for *wiliwili* (*E. sandwicensis*) (Price et al. 2007). However, numerous areas in southeastern Maui located between Pu'u Ola'i and Kaupo outside the Property did appear as having 'high' habitat characteristics on the maps prepared by Price et al (2007).

2.0 METHODS

Spatially explicit information on the composition and structure of plant communities within the Property is needed to meet the survey objectives, especially if data are to be used to make conservation, management and long-term monitoring and ecological research recommendations for the Property. However, the relatively small Property and the nature of the understory vegetation prevent the effective application of remote sensing technologies typically used in vegetation mapping. Therefore, SWCA botanists developed a sampling method to meet all three study objectives. High resolution field sampling techniques were designed based upon previous reconnaissance surveys conducted by SWCA, cooperating government, and other scientists on March 6-8, 13-15, 24-26, 2006; January 4-5, February 24-26, and October 18, 2007.

2.1 Field Surveys

A modified one-dimensional line transect method of plot-less sampling (Barbour et al. 1987) was employed by SWCA botanists across the entire Property. Linear transects were established at regular 20 m (65.6 ft) intervals across the remnant mixed *kiawe-wiliwili* shrubland in the southern portion of the Property, and at regular 50 m (164 ft) intervals across the entire northern portion of the Property (Figure 4). Transects in the northern portion of the Property were placed 50 m apart because, compared to the southern rugged 'a'ā lava flow with scrub vegetation, the northern 200 ha (495 acres) of Property is open pastureland and is known to harbor fewer native plant species (Char and Linney, 1988 and Altenberg 2007). The advantages of plot-less sampling are: 1) a sample plot does not need to be established, saving time; and 2) elimination of subjective error associated with the sample plot boundaries. This method also allowed us to sweep the entire project site to record more native plants than would have been found through sample plots and/or quadrats.

Transects were pre-established on an 800 × 1200 m (0.5 × 0.75 mi) map-overlay with ARC GIS software developed by Environmental Science Research Insititute (ESRI), and pre-loaded into Trimble GeoXT (Pocket PC) Global Positioning System (GPS) units with Terrasync 2.4 GPS software. Field surveys for this study were conducted within the southern 70 ha (173 acres) of scrub vegetation on March 8-10, 2008 and March 29-31, 2008, by botanists Shahin Ansari, Ph.D., Maya LeGrande, M.S., Ane Bakutis, M.S., Hina Kneuble, M.S., Talia Portner, B.S., Tiffany Thair, (M.S. candidate), and GIS Analyst Ryan Taira, B.A.

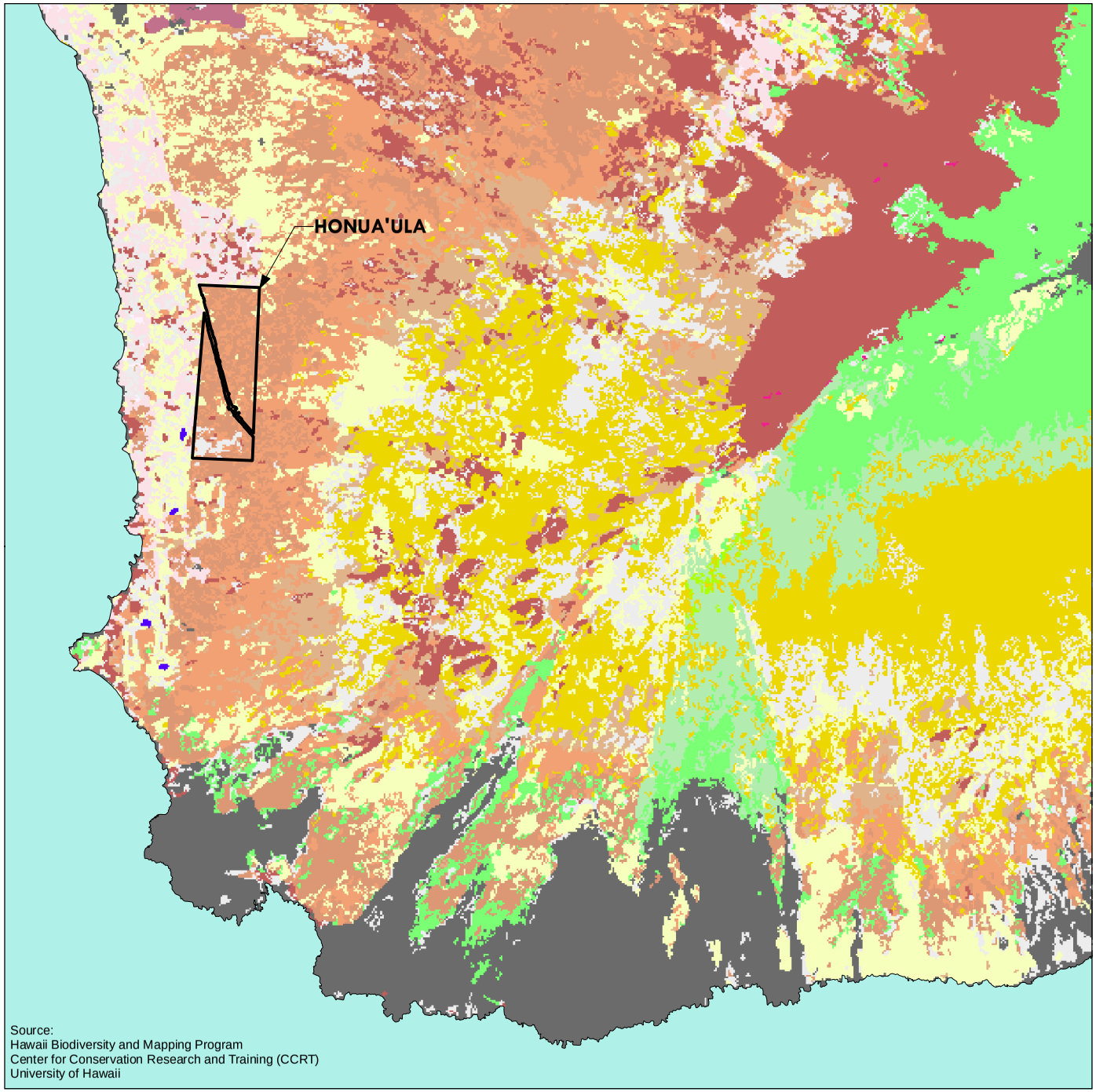

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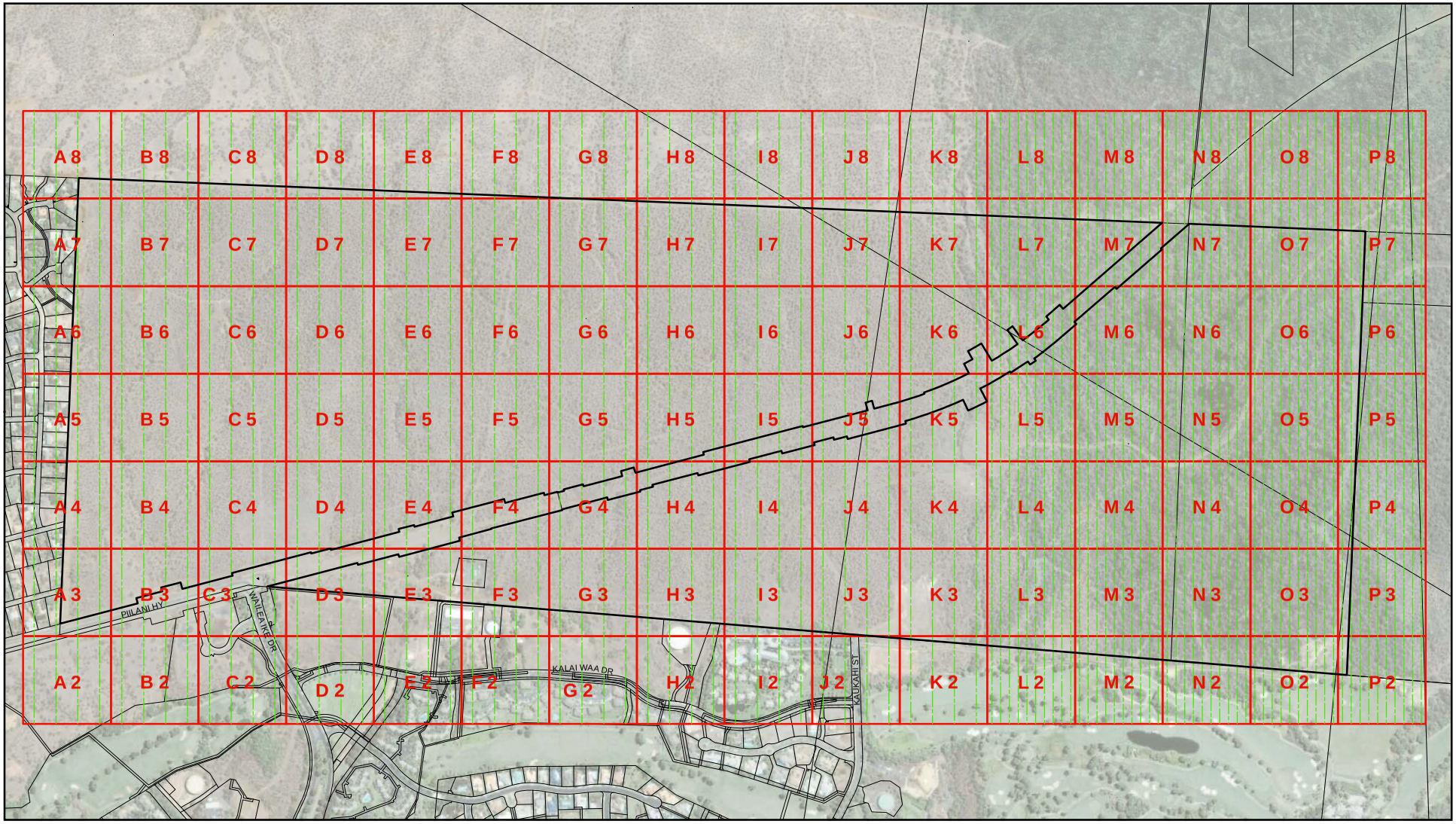
Figure 3
HI-GAP Landcover

Appendix 1



Appendix 1

Legend

- Transects
- Parcels
- Project Boundary
- 200 Meter Grid

Figure 4
Grid and Transects Map

0 250 500 1,000 ft

N

0 50 100 200 M

Parcel and Boundary Source: PBR Hawaii

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The northern portion of the Property was surveyed by the team on May 27- 29, 2008. Three two-person teams concurrently walked abreast along adjacent transects. Each team was responsible for locating and mapping native plants 10 m (33 ft) on either side of each transect. At each plant feature, 10 to 15 data points were collected and averaged to produce a single GPS point. GPS data was collected along transects using Wide Area Augmentation System (WAAS) for real time differential GPS (DGPS). At the end of each transect, the botanists moved to adjacent transects to continue their search until all transects were surveyed. Mapping was conducted at an approximate rate of 0.4 km/ hr (0.25 miles/ hr). Surveys commenced at the southeastern corner of the Property (grid P8) and proceeded to the south-west corner (grid P2; Figure 4). The entire length of each transect was surveyed, totaling 78,500 m (48.7 mi) across the Property.

A single GPS point was collected at the center of each discrete patch of vines, herbaceous and small shrub species. Herbs, shrubs, and vines less than 15 cm (6 inch) tall that were not flowering or fruiting were considered seedlings. For each patch, the botanists documented the phenology, number of individuals (seedlings and adults), aerial diameter of the patch (m), presence/ absence of signs of herbivory (such as chewed leaves or stems, scraping of the leaf surface), damage (broken off branches) and/or disease (wilting, yellowing of the whole or part of the plant). If patches were very large (> 5 m² or 54 ft²), a GPS point was collected every 5 m^2. Where multiple *wiliwili* trees (*E. sandwicensis*) were found with overlapping canopies, a single GPS point was collected at the approximate center of the grove of trees. Botanists also noted the aerial canopy diameter and the number of seedlings/ juveniles and adult plants within a grove. Large tree species with trunks less than 15 cm (6 inch) in diameter were regarded as juveniles.

Hoary abutilon (*Abutilon incanum), koali awahia* (*Ipomoea indica*)*, 'ilima (Sida fallax), popolo* (*Solanum americanum*), *'ilie'e* (*Plumbago zeylanica*), *alena* (*Boerhavia* spp.), and *'uhaloa* (*Waltheria indica*) were abundant and widespread indigenous (versus endemic) species common throughout the southern 'a'ā lava flow. Therefore, individuals of these species were not mapped. This is consistent with the methods of Altenberg (2007).

2.2 Mapping and Data Analysis

GPS field data was post-processed with GPS Pathfinder Office software and used to differentially correct to a Continuously Operating Reference Station (CORS). Most features were accurate to sub-meter precision. Data was exported in ESRI ArcGIS to shape file format in NAD 83 (Cors 96) UTM Zone 4 meters using WGS 84 to NAD 83_4 transformation. ESRI ArcView 9.2 software was used for digital mapping.

To better visualize the distribution of native plant species, a graduated circle map was created showing the distribution of all species based on the number of plants mapped at each location (GPS point). Circles of different color represent different species, the size of the circle reflects the number of individuals mapped at each location and assigned to one of six count classes; 1-5, 6-10, 11-15, 16-25, 26-60, and 61-110 individuals. While the graduated circle map is informative, a more effective way to find the greatest concentration of the native plant resources is to map the densities of each species.

Vegetation density maps were created using kernel density which is based on the quadratic kernel function described in Silverman (1986). The 26 native species known to occur in the Property were arranged in order of their relative importance by the project botanists and only the top eight endemic and indigenous plant species that are uncommon within the Property and elsewhere in the State were included in the GIS density analysis (Table 1). Density of these selected eight native plant species was evaluated as a means of identifying suitable boundaries for a Native Plant Preservation Area within a portion of the Property based upon their greatest concentration.

Using the ArcView GIS Spatial Analyst extension, SWCA converted species count classes of the eight species to density (number of species/acre) classes. These resulting density maps allow comparison of native plants on the same spatial scale. However, density maps for these species varied greatly from 0-57 plants per acre for *wiliwili* (*Erythrina sandwicensis*) to 0-1 plant per acre for *'āwikiwiki* (*Canavalia pubescens*). Therefore, the maps were further standardized by reclassifying the densities for the species to a common scale where nine (9) represented the highest density for each species and one (1) represented lowest. The reclassified density maps

were then overlaid with a percent weight assigned to each. Each species was assigned a different weight by the project botanists based on their relative botanical importance throughout the State and Property (Table 2). The density maps and the overlay analysis were developed using 100 m (328 ft) resolution to define specific and contiguous preservation areas that protect the greatest concentration of rare native plant species within the Property.

Table 1. Native plants reported from the Property arranged in order of their relative importance by project botanists. *Group 1 = endemic (E) and indigenous (I) plants uncommon within the Property as well as elsewhere in the State, and/or of significance to life stages of the endangered Blackburn sphinx moth (Manduca blackburni); Group 2 = relatively common endemic species throughout Hawai'i, Group 3 = relatively common native (indigenous) species throughout Hawai'i.*

Species	Status	Hawaiian Name	Family
GROUP 1			
Lipochaeta rockii	E	*nehe*	Asteraceae
Canavalia pubescens	E	*paunu*	Fabaceae
Erythrina sandwicensis	E	*wiliwili*	Fabaceae
Capparis sandwichiana	E	*maiapilo*	Capparaceae
Senna gaudichaudii	I	*kolomona*	Fabaceae
Sicyos hispidus	E	*'ānunu*	Cucurbitaceae
Sicyos pachycarpus	E	*'ānunu*	Cucurbitaceae
Chamaesyce celastroides var. *lorifolia**	E	*'akoko*	Euphorbiaceae
Argemone glauca	E	*pua kala*	Papaveraceae
GROUP 2			
Myoporum sandwicense	E	*naio*	Myoporaceae
Panicum torridum	E	*kakonakona*	Poaceae
Heteropogon contortus	E	*pili*	Poaceae
Ipomoea tuboides	E	*ipomea*	Convolvulaceae
Boerhavia herbstii	E	*alena*	Nyctaginaceae
Doryopteris decipiens	E	*'iwa'iwa*	Adiantaceae
Plumbago zeylanica	E	*'ilie'e*	Plumbaginaceae
GROUP 3			
Dodonaea viscosa	I	*'a'ali'i*	Sapindaceae
Sida fallax	I	*'ilima*	Malvaceae
Boerhavia spp.**	I	*alena*	Nyctaginaceae
Abutilon incanum	I	hoary abutilon	Malvaceae
Ipomoea indica	I	*koali awahia*	Convolvulaceae
Waltheria indica	I	*'uhaloa*	Sterculiaceae
Pellaea ternifolia	I	*pellaea*	Adiantaceae
Adiantum capillus-veneris	I	maidenhair fern	Pteridaceae
Solanum americanum	I	*popolo*	Solanaceae

** A single stunted akoko was found within the Property in 2006; however, the plant was found to be dead in the late summer of 2007, and was not found at all during the 2008 surveys. Therefore, it is not considered in further plant density analysis for the purpose of defining boundaries of the native plant preserve.*
*** Two indigenous species of Boerhavia (repens and acutifolia) were reported within the Property during the SWCA surveys. Char and Linney (1988) and Char (1993, 2004) also found B. repens within the Property.*

2.3 Regional Assessment of *Wiliwili* Abundance

A low-altitude qualitative aerial survey of southeast Maui was conducted by biologists Robert Kinzie, Ph.D., John Ford, M.S., and GIS Analyst Ryan Taira, B.A. on July 11, 2008 to identify and photograph other areas where *wiliwili* (*Erythrina sandvicensis*) is common. During summer months, *wiliwili* (*E. sandwicensis*) trees drop their leaves and are easy to identify from the air. The aerial survey began at Kahului International Airport and extended along the Kīhei coast over undeveloped lands between 300-450 m (980-1500 ft) elevation toward the southeast to Lualailua, at altitudes ranging from 15-150 m (50-500 ft) above ground level (AGL).

Still photos and videos of *wiliwili* (*E. sandwicensis*) were collected with a SONY DCR-SR100 digital video camera with a Carl Zeiss® Vario-Sonnar® T lens. Still photos were also taken with a Pentax Optio W30 digital camera with a Pentax 6.3mm lens. *Wiliwili* (*E. sandwicensis*) trees within the Pu'u O Kali Preserve, Honua'ula, adjacent 'Ulupalakua Ranch and Makena Resort lands, Makena State Park, lands east of Pu'u Olai, Ahihi-Kinau, Kanaio, and Lualailua were photographed.

Table 2. Percent weight assigned for the eight species selected for density analysis; *based on their relative botanical importance throughout the State and the Honua'ula Project site.*

Species	Common Name	Percent Weight
Lipochaeta rockii (E)	*nehe*	16
Canavalia pubescens (E)	*paunu*	15
Erythrina sandwicensis (E)	*wiliwili*	14
Capparis sandwichiana (E)	*maiapilo*	13
Senna gaudichaudii (I)	*kolomona*	12
Sicyos hispidus (E)	*'ānunu*	11
Sicyos pachycarpus (E)	*'ānunu*	10
Argemone glauca (E)	*pua kala*	9

3.0 RESULTS

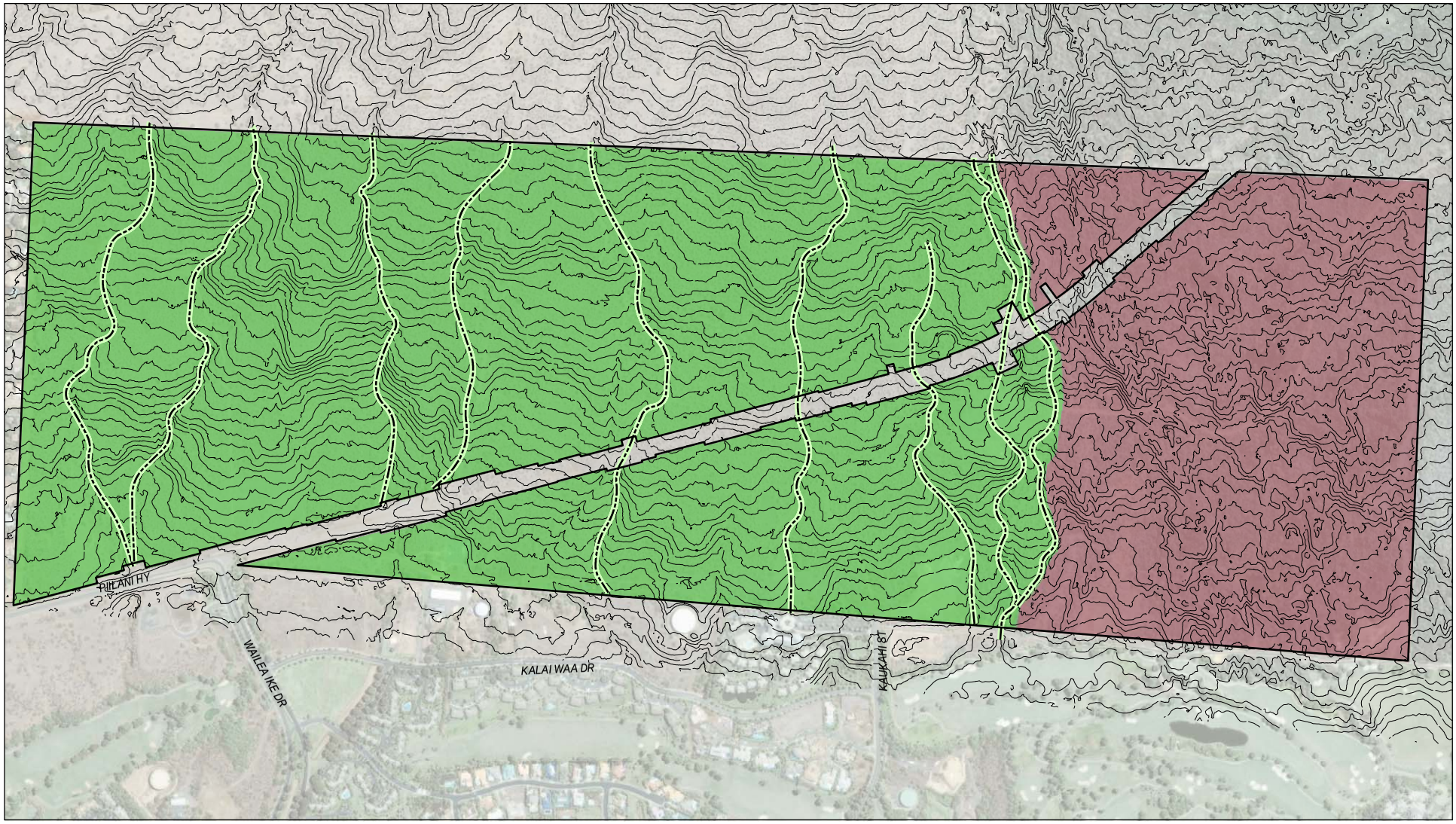
A complete list of all plants found within the site is provided in Appendix A. *Portulaca* sp. nov. was reported by Char and Linney (1988); however, it is not included in Appendix A because the species level was never determined and no known collections were made by Char and Linney (1988). All the native plant species described from the Property are known to occur elsewhere on Maui and the main Hawaiian Islands. Only the unique leaf form of Rock's *nehe* (*Lipochaeta rockii*) appears to be limited to the Property. Table 3 illustrates the occurrence of adult and seedling native plants within the Property.

Table 3. A comparison of the number of native plants and seedlings observed within the entire Honua'ula Property and the remnant mixed kiawe-wiliwili shrubland in the southern portion of the Property. *Prop = entire Honua'ula Property, KW = kiawe-wiliwili shrubland.*

Species (Hawaiian name)	Number of Points		Number of Seedlings		Number of Adults		Total Numbers Observed	
	KW	Prop	KW	Prop	KW	Prop	KW	Prop
Argemone glauca (pua kala)	26	26	247	247	165	165	412	412
Canavalia pubescens ('āwikiwiki)	5	5	0	0	5	5	5	5
Capparis sandwichiana (maiapilo)	311	312	14	14	548	549	562	563
Dodonea viscosa ('a'ali'i)	7	7	0	0	16	16	16	16
Doryopteris decipiens ('iwa'iwa)	2	14	0	2	7	52	7	54
Erythrina sandwicensis (wiliwili)	546	569	334	341	2105	2137	2439	2478
Heteropogon contortus (pili)	0	66	0	384	0	1109	0	1493
Ipomoea tuboides (ipomea)	5	5	0	0	5	5	5	5
Lipochaeta rockii (nehe)	24	24	56	56	45	45	101	101
Myoporum sandwicense (naio)	17	17	0	0	21	21	21	21
Senna gaudichaudii (kolomona)	28	32	1	5	36	38	37	43
Sicyos hispidus ('ānunu)	48	49	5	5	107	108	112	113
Sicyos pachycarpus ('ānunu)	101	102	313	313	289	290	602	603

3.1 Vegetation

Similar to the vegetation categories described by Char and Linney (1988), SWCA found three distinct vegetation types within the Property (see Figure 5). Each of these is described in the following paragraphs. Figure 6 illustrates the percent of introduced and native plants reported from each of the three predominant vegetation types.



Legend
- Project Boundary

Vegetation Types
- Kiawe-buffel Grass Grassland
- Kiawe-wiliwili Shrubland
- Gulch Vegetation

Appendix 1

Figure 5
Vegetation Types

0 250 500 1,000 ft
0 50 100 200 M
N

Boundary Source: PBR Hawaii
Aerial Source: Microsoft 2009

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3.1.1 *Kiawe*-Buffelgrass Grassland

About 75% of the northern portion of the project parcel is characterized by an extensive grassland comprised primarily of *kiawe* (*Prosopis pallida*) *and* buffelgrass (*Cenchrus ciliaris*). There is scattered evidence that trespassers may be logging *kiawe* (*P. pallida*) trees for charcoal in this area. Guinea grass (*Urochloa maxima*), natal redtop (*Rhynchelytrum repens*), and sour grass (*Digitaria insularis*) are also scattered throughout the northern portion of the Property. Other plants found here include the invasive *koa haole* (*Leucaena leucocephala*), lantana (*Lantana camara*), partridge pea (*Chamaecrista nictitans*) and cow pea (*Macroptilium lathyroides*).

The area has been disturbed throughout by numerous jeep trails and unrestricted grazing by axis deer. Some open areas that appeared to be heavily grazed were devoid of buffelgrass (*Cenchrus ciliaris*), but contained the native shrubs *'ilima* (*Sida fallax*) and hoary abutilon (*Abutilon incanum*), and the introduced golden crown beard (*Verbesina encelioides*).

3.1.2 Gulch Vegetation

The vast expanse of *kiawe*-buffelgrass in the northern three quarters of the Property is bisected from east to west by several gulches that carry flood waters to the sea (Figure 5). These intermittent gulches vary in depth and are characterized by patches of exposed bedrock. The gulches are shaded by their steep walls providing relatively cool and moist conditions. Three species of ferns including maidenhair fern (*Adiantum capillus-veneris*), sword fern (*Nephrolepis multiflora*), and the endemic *'iwa'iwa* fern (*Doryopteris decipiens*) were found in the shaded rocky outcrops and crevices within the gulches. Native *Pili* grass (*Heteropogon contortus*) was found in more open and sunny locations. Other species found within the gulches include tree tobacco (*Nicotiana glauca*), *wiliwili* (*Erythrina sandwicensis*), lantana (*Lantana camara*), partridge pea (*Chamaecrista nictitans*), golden crownbeard (*Verbesina encelioides*), *'ilima* (*Sida fallax*), hoary abutilon (*Abutilon incanum*), *koa haole* (*Leucaena leucocephala*), indigo (*Indigofera suffruticosa*), *'uhaloa* (*Waltheria indica*) and lion's ear (*Leonotis nepetifolia*).

3.1.3 Mixed *Kiawe*-*Wiliwili* Shrubland

Remnant mixed *kiawe-wiliwili* shrubland was limited to the southern 'a'ā lava flow in the southern quarter of Property (Figure 5). Scattered groves of large-stature *wiliwili* (*Erythrina sandwicensis*) and *kiawe* trees co-dominated the upper story. Native shrubs, such as *'ilima* (*Sida fallax*) and *maiapilo* (*Capparis sandwichiana*), and the native vine *'ānunu* (*Sicyos pachycarpus*), were represented in the understory. Introduced shrubs, introduced grasses, and introduced vines and herbaceous species dominated the ground vegetation. Lantana (*Lantana camara*), found throughout the mixed *kiawe-wiliwili* shrubland, showed signs of dieback. Although abundant, the guinea grass (*Urochloa maxima*) found on the site was grazed to stubble, probably by axis deer.

3.2 Endangered, Threatened, and Candidate Endangered Species of Plants

No Federal or State of Hawai'i listed threatened, or endangered plant species were found in the Property. Over a period of time, Altenberg (2007) collected roughly 15 GPS points for *'āwikiwiki* vines (*Canavalia pubescens*) within the *kiawe-wiliwili* shrubland during his hikes across the Honua'ula parcel. It is unknown how many of his GPS points represent duplicate occurrences of the same plant. The U.S. Fish and Wildlife Service (2009) reported "a few individuals at Palauea-Keahou" [including the Property] based upon information received from Altenburg (2007) and Hank Oppenheimer (Plant Extinction Prevention Program, pers. comm.). During this study, the project botanists found only five (5) individual *'āwikiwiki* (*C. pubescens*) plants on the Property. All *'āwikiwiki* (*C. pubescens*) were flowering and fruiting at the time of the survey; however, no seedlings were detected. The plants appeared to be healthy with no signs of damage or disease.

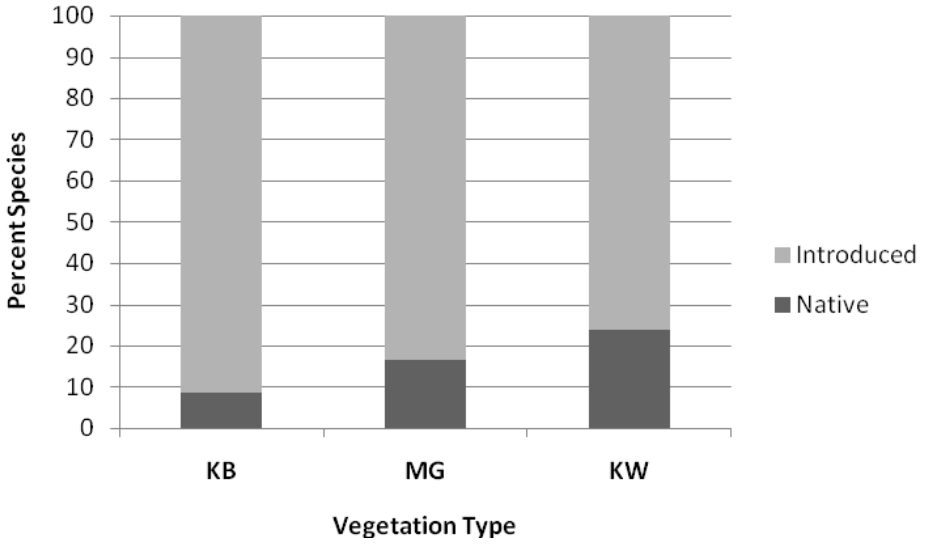

Figure 6. ***Percent of native and introduced plant species found in each of the three predominant vegetation types within the Property.*** *Data is pooled across all plant species (n= 146) observed by Char and Linney (1988), Altenberg (2007) and SWCA (this study). KB = Kiawe-buffelgrass grassland (n= 105, 9 natives and 96 introduced), MG = mixed gulch vegetation (n= 66, 11 natives and 55 introduced), KW = kiawe-wiliwili shrubland (n= 106, 26 natives and 80 introduced).*

3.3 Distribution and Abundance of Native Plant Species

In all, 146 plant species have been identified within the Property, 26 of which are native, 14 of these endemic. The remaining 120 plant species are introduced non-native species. Of the 26 native species reported in previous surveys (Char and Linney 1988, Altenberg 2007), we found 21 during this study. We did not observe *Panicum torridum*, *Boerhavia herbstii*, *Adiantum capillus-veneris*, *Chamaesyce celastroides* and *Pallaea ternifolia* during our surveys. Figure 7 illustrates the location of native plants within the Property, and Figure 8 illustrates the distribution of native plant species within the Property by count.

As previously mentioned, hoary abutilon (*Abutilon incanum), koali awahia* (*Ipomoea indica*), *'ilima (Sida fallax), popolo* (*Solanum americanum*), *'ilie'e* (*Plumbago zeylanica*), *alena* (*Boerhavia* spp.), and *'uhaloa* (*Waltheria indica*) were abundant and widespread throughout the *kiawe-wiliwili* shrubland, and therefore were not mapped since it was not feasible to collect GPS data for each individual plant. Aside from these species and *'āwikiwiki* (*Canavalia pubescens*), which is discussed above and at length in Section 4.0, descriptions of the remaining native plants found on the Property appear below. Individual fact sheets, including photographs and distribution maps, of the native plants mapped by SWCA are found in Appendix B in alphabetical order by species name.

SWCA botanists found 412 *pua kala* (*Argemone glauca*) in 26 locations within the Property, all of which were limited to the southern 'a'ā portion of the Property (Table 3, Figure 8). Most clusters averaged 16 individuals, most of which were seedlings (60%). Clusters ranged from one to 39 m^2 with the average being 4 m^2 (n= 26 clusters). The majority of clusters occurred in the southwestern portion of the *kiawe-wiliwili* shrubland, usually in relatively open, sunny locations of the lava flow. All plants of this species we observed were flowering at the time of the surveys.

Maiapilo (*Capparis sandwichiana*) is a common shrub throughout the understory of the remnant mixed *kiawe-wiliwili* shrubland. We found 563 *maiapilo* during the survey and all but one individual was located in the southern 'a'ā portion of the Property (Table 3, Figure 8). Most clusters ranged from one to five individuals; 11 were larger, consisting of six to 10 individuals.

Appendix 1

Legend

- Project Boundary
- Native Plant Points

Figure 7
Native Plant Occurrences

0 250 500 1,000 ft

0 50 100 200 M

N

Native Plant Source: Trimble GeoXT GPS
Boundary Source: PBR Hawaii
Aerial Source: Microsoft 2009

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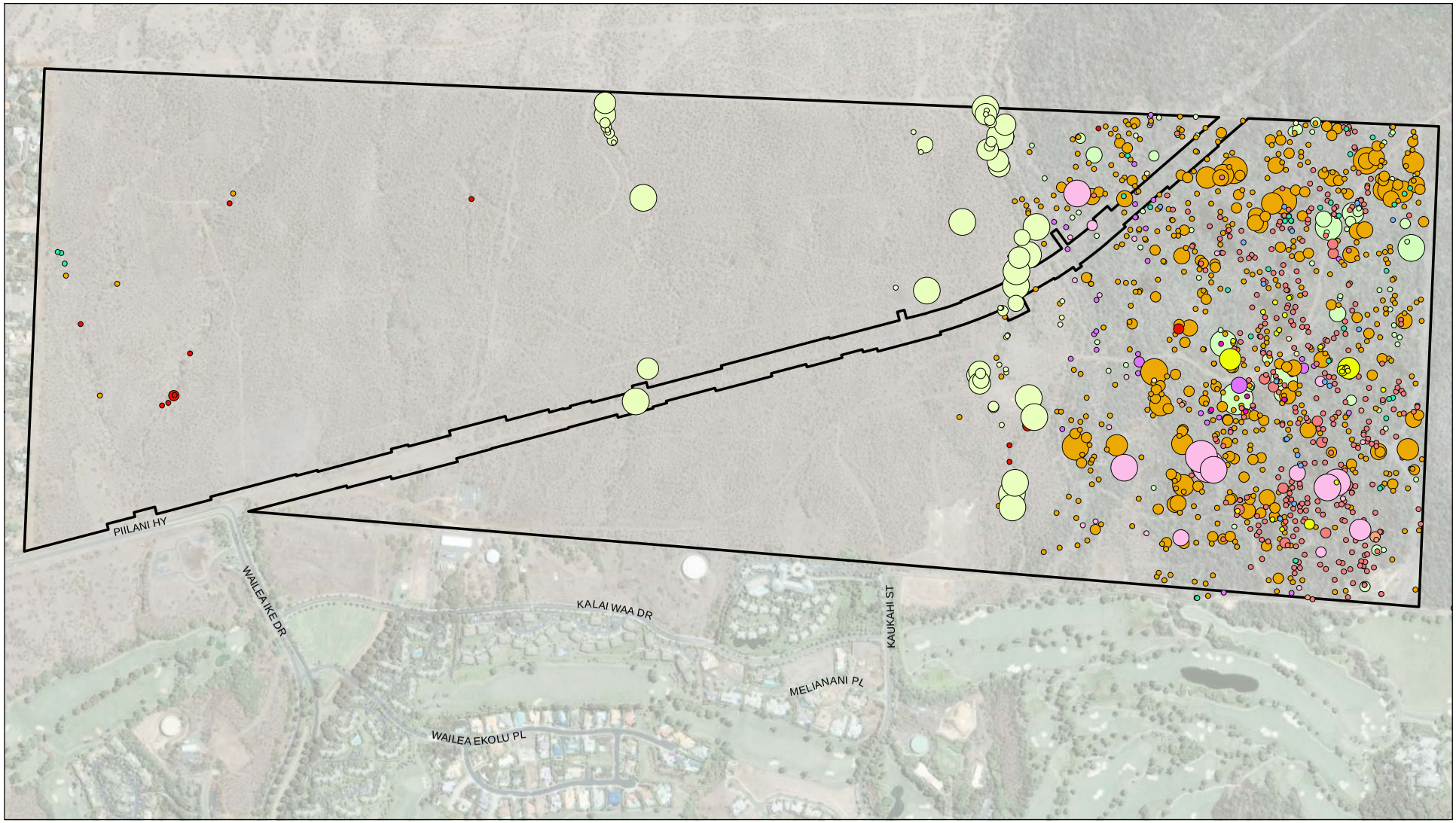

Appendix 1

Native Plants by Species

- *Argemone glauca*
- *Canavalia pubescens*
- *Capparis sandwichiana*
- *Doryopteris decipiens*
- *Dodonea viscosa*
- *Erythrina sandwicensis*
- *Heteropogon contortus*
- *Ipomoea tuboides*
- *Lipochaeta rockii*
- *Myoporum sandwicense*
- *Senna gaudichaudii*
- *Sicyos hispidus*
- *Sicyos pachycarpus*

Native Plants by Count Classes

- 1 - 5
- 6 - 10
- 11 - 15
- 16 - 25
- 26 - 60
- 61 - 110

Plant Source: Native Plants were mapped with GPS
Boundary Source: PBR Hawaii
Aerial Source: Microsoft 2009

Figure 8
Native Plant Count Classes

N

0 250 500 1,000 ft

0 50 100 200 M

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These large clusters were found primarily in the southern portion of the *kiawe-wiliwili* shrubland. The aerial cover of the largest cluster was 531 m^2, others ranged from one to 314 m^2 (average cover of 17 m^2). Several *maiapilo* clusters were flowering and fruiting, but the frequency of seedlings was low (2.5%). About 20% of the plants showed mild to heavy signs of insect herbivory where the epidermis (upper layer of the leaves) appeared to be scraped away.

We observed 16 *'a'ali'i* (*Dodonaea viscosa*) shrubs in seven locations, all limited to the southwestern corner of the *kiawe-wiliwili* shrubland (Figure 8). Six of the seven locations had one to four individuals while the largest cluster was comprised of six individuals. Average cover of *'a'ali'i* was about 26 m^2 where the aerial cover of two clusters were 79 m^2 each and the remaining five ranged from one to 20 m^2. One plant was observed fruiting and no seedlings were observed in the vicinity of the adult shrubs. All plants were healthy with no detectable signs of damage, disease, or herbivory.

Fifty-four *'iwa'iwa* (*Doryopteris decipiens*) ferns were distributed at about 14 locations within the Property (Figure 8). Of these, only seven individuals were found within the *kiawe-wiliwili* shrubland; the others occurred in the drainage gulches within the northern portion of the Property. The number of individuals within a cluster ranged from one to 16, the majority of which were adults (96%). Some plants showed signs of dehydration; most plants in the largest cluster (16 individuals) were very dry. Aerial cover of the largest cluster was approximately 7 m^2 while the others ranged from one to 3 m^2.

Wiliwili (*Erythrina sandwicensis*) was the most common native tree species in the southern 'a'ā lava flow (Table 3, Figure 8). We mapped 2,476 individuals distributed throughout the Property. The majority (2439 individuals) were limited to the *kiawe-wiliwili* shrubland in groves of various sizes. The largest groves (>15 individuals) tended to be located in the eastern portion of the *kiawe-wiliwili* shrubland. The number of adult *wiliwili* (*E. sandwicensis*) trees was greater (86%) than seedlings and juveniles (Table 3). Most *wiliwili* trees showed some form of damage, primarily from the Erythrina gall wasp (*Quadristichus erythrinae* Kim) and the seed eating bruchid beetle (*Specularius impressithorax* Pic). Additional information on the *wiliwili* (*E. sandwicensis*) within the Property can be found in Table 4.

Table 4. Number of wiliwili (Erythrina sandwicensis) groves on the project site. *Grove size is categorized by the number of individual trees in the grove. Range and average canopy cover is measured in m^2.*

Number of Trees in Grove	Number of Groves	Range in Grove Canopy Cover (min-max) (m^2)	Mean Canopy Cover of the Grove (m^2) (+/- 1 S.E.)	Median Grove Canopy Cover (m^2)
1 to 5	417	0.8 - 1589.6	94.1	38.5
6 to 10	107	28.3 – 2862	523.5	254.3
11 to 15	28	12.6 - 706.5	839.1	706.5
16 to 25	12	314 – 2862	1453.9	961.6
26 to 60	5	254.3 - 1962.5	1029.2	873.3

Pili grass (*Heteropogon contortus*) was the only native grass species found within the Property (Figure 8). *Pili* (*H. contortus*) was limited to gulches within the *kiawe*-buffelgrass grassland in the northern half of the Property (Table 3). We mapped 1,493 *pili* (*H. contortus*) plants in 66 locations within the Property. All plants were limited to gulches within the *kiawe*-buffelgrass grassland in the northern half of the Property. Most individuals occurred in the southern drainage gullies of the grassland, becoming less abundant to the north. Adult plants were flowering at the time of our surveys. We did not observe signs of superficial damage or disease.

Five endemic Hawaiian moon flower (*Ipomoea tuboides*) vines were observed within the Property; all of which are limited to the southern 'a'ā portion of the Property (Table 3, Figure 8). At the time of the survey all plants were flowering.

One hundred and one *nehe* (*Lipochaeta rockii*) were found distributed in 24 clusters across the Property (Figure 8). All were within the southern 'a'ā portion of the Property. Two large clusters

contained 22 and 23 individuals respectively and were located in the center of the mixed *kiawe-wiliwili* shrubland. Smaller clusters (< 10 individuals) were found from central to southwestern portion of the shrubland. Clusters ranged from < 1 m^2 to 78.5 m^2 in area.

Twenty-one *naio* (*Myoporum sandwicense*) shrubs/trees were observed in 17 locations distributed throughout the *kiawe-wiliwili* shrubland (Table 3, Figure 8). No *naio* (*M. sandwicense*) seedlings were found. Fifteen of the 17 locations were occupied by a single shrub/tree. Aerial cover ranged from < 1 m^2 to 78.5 m^2, the largest of which consisted of three shrubs/trees.

Forty-three *kolomona* (*Senna gaudichaudii*) trees were mapped at 32 locations within the Property (Figure 8). The majority (37 individuals) of the plants occurred in the southern portion of the mixed *kiawe-wiliwili* shrubland. The cluster size ranged from one to five individuals, and 24 of 29 mapped locations consisted of solitary plants. The areal extent ranged from < 1 m^2 to 19.6 m^2. Evidence of herbivory was observed at four of 29 locations. Many of the plants found were flowering and/ or fruiting at the time of our surveys.

We mapped 113 *'ānunu* (*Sicyos hispidus*) vines at 49 locations within the Property (Table 3, Figure 8). These vines occurred primarily in the central and northern edge of the 'a'ā lava flow. Larger clusters (> 5 individuals) tended to be located in the central portion of the *kiawe-wiliwili* shrubland. Seedlings were observed at only one location and no signs of damage or herbivory were detected.

A second species of *'ānunu* (*Sicyos pachycarpus*) was found within the Property (Figure 8). Six hundred and three *S. pachycarpus* were mapped in 102 locations. The size of clusters varied greatly and ranged from one to 110 plants per location. The majority of the larger clusters (> 15 individuals) were concentrated in the center of the *kiawe-wiliwili* shrubland. Approximately 52% of mapped plants were seedlings. Many adults were observed flowering and/ or fruiting. Most of the vines appeared to be healthy; only one plant showed signs of herbivory.

3.4 GIS Density Analysis

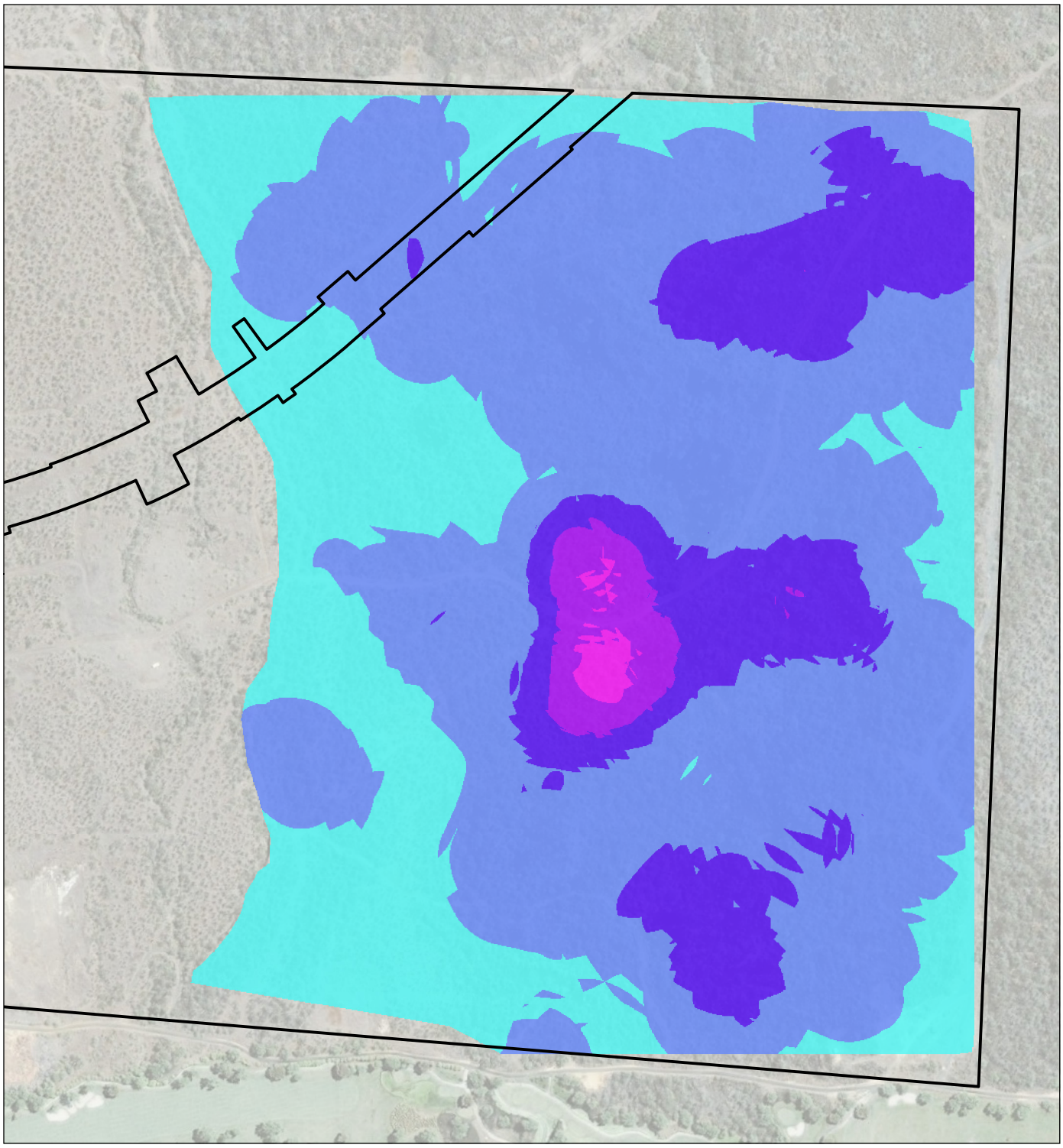
Table 2 illustrates how SWCA botanists weighted each species in Group 1 (from Table 1) for density analysis. The resulting density analysis, conducted at a resolution of 100 m (328 ft) illustrated the core areas occupied by the highest densities of the most significant plant species. Figure 9 illustrates the results of the weighted density analysis for the eight most important native plant species. The colors represent the weighted average of the densities of the eight species.

3.5 Aerial Reconnaissance Survey

Wiliwili (*E. sandwicensis*) and *kiawe* (*P. pallida*) trees were the most distinctive tree species observed from aerial surveys. In contrast, understory was difficult if not impossible to identify from the air. Dense stands of *wiliwili* trees (*E. sandwicensis*) were found in several areas adjacent to, and well outside of, the Property (Figure 10). This includes a large geographical area of approximately 400 ha (1,000 ac) east of Pu'u Olai (Figure 11), stretching from the southern boundary of the Property into the Makena property and Ahihi-Kinau Natural Area Reserve in the south, and from the Makena Resorts southeast of Honua'ula toward the 'Ulupalakua Ranch. Our aerial reconnaissance confirmed input from others (A.C. Medeiros, USGS, pers. comm.; Altenberg 2007) suggesting that several additional high density *wiliwili* (*E. sandwicensis*) groves may be found near Pu'u Olai, Kanaio, Pu'u O Kali, Makena (Figure 12), La Perouse, Kaupo, and Lualailua.

4.0 DISCUSSION

The Property was viewed by Char and Linney (1988) and Char (1993, 2004) as having unremarkable vegetation. Until SWCA (2006) and Altenberg (2007), there had been no recognition of the remnant mixed *kiawe-wiliwili* shrubland as an area worthy of special recognition. Similarly, there have been no previous efforts by any Federal, State, local government agency, or conservation Non-governmental organizations (NGOs) to acquire and protect any portion of the Property.



Weighted Average

- 5 - Highest Weighted Average
- 4
- 3
- 2
- 1 - Lowest Weighted Average

Figure 9
Visual Representation of Weighted Density Analysis of the Eight Most Important Plant Species within the Project Area

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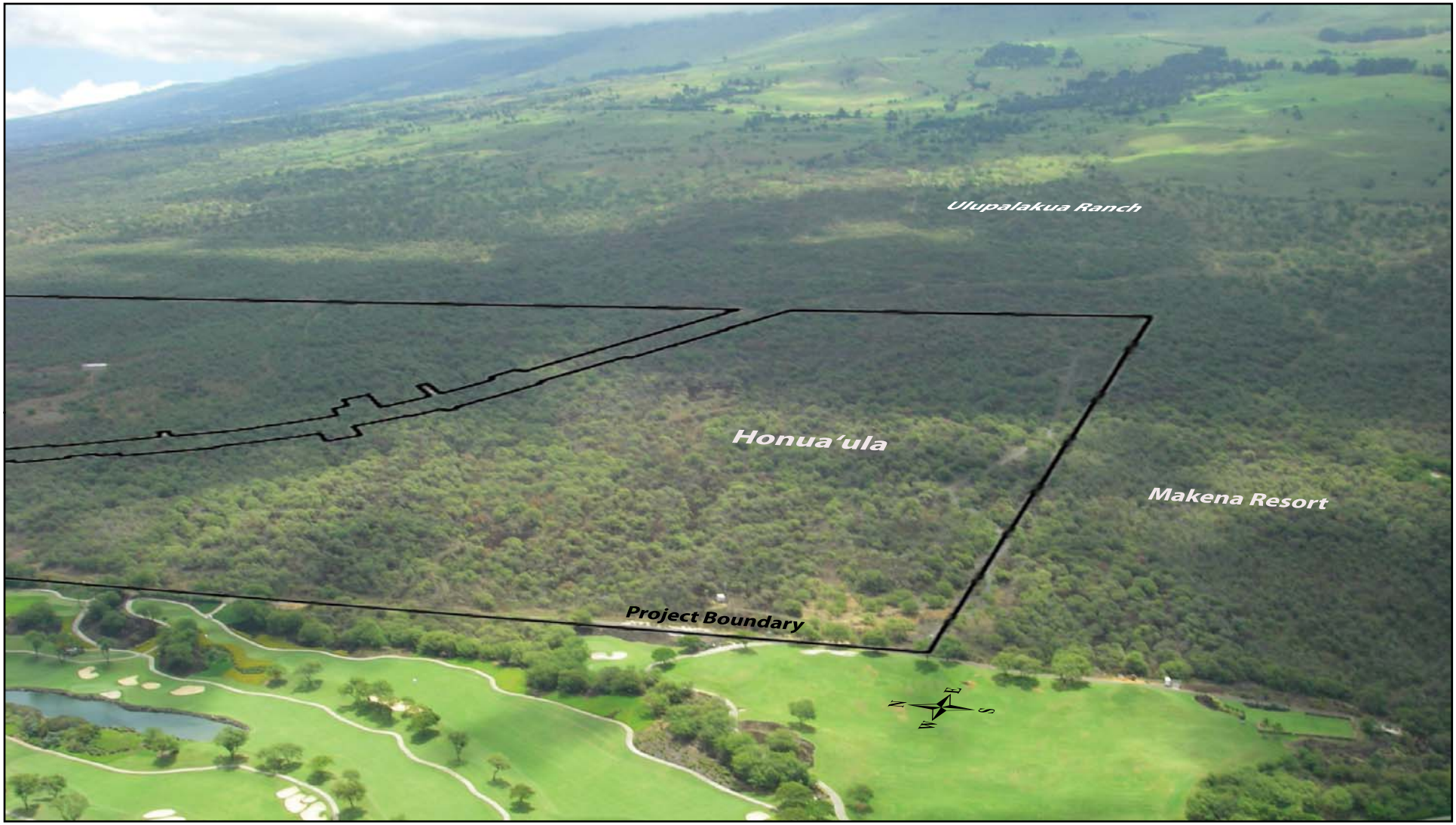


Figure 10 - An east-northeasterly aerial view of the remnant mixed kiawe-wiliwili shrubland within and adjacent to the southern and southeastern boundaries of Honua'ula, on Makena Resort and Ulupalakua Ranch lands, respectively.

Figure 11 - A westerly aerial view of the dense remnant mixed kiawe-wiliwili shrublands adjacent to Pu‘u Olai.

Figure 12. An easterly aerial view of dense remnant mixed kiawe-wiliwili shrublands surrounding the Makena Sewage Treatment Facility.

The remnant native vegetation in the remnant mixed *kiawe-wiliwili* shrubland represents a highly degraded lowland dry shrubland in which *wiliwili* trees (*E. sandwicensis*) are a natural component. High density *wiliwili* (*E. sandwicensis*) stands occur in other locations throughout the region. Altenberg (2007) identified eight areas in southeast Maui, including the Property, where *wiliwili* (*E. sandwicensis*) groves are found. In this study, we also found dense *wiliwili* (*E. sandwicensis*) groves east of Pu'u Olai.

Far from being pristine, this dry shrubland has been degraded by human activities including unrestricted grazing by ungulates, cattle grazing, invasive plant species, road works, *kiawe* (*P. pallida*) logging, and military activities. Only 26 of the 146 species reported from the parcel are native, 14 of these are endemic, and 120 are introduced non-native species (Figure 6).

Canavalia pubescens Hook. & Arnott is "…uncommon in open dry sites such as lava fields, kiawe thickets, and dry forest, 15-540m, on Ni'ihau, Kaua'i (Nāpali Coast), Lāna'i, and leeward East Maui" (Wagner et al. 1999). In 1997, the species was added as a candidate species by the U.S. Fish and Wildlife Service (USFWS). The most recent USFWS (2009) information on the species includes the following:

> *"Canavalia pubescens is found on dry, open lava fields and in dryland forest. On Kauai, C. pubescens was found in open, moist forest and in dry scrub forest at elevations between 180 to 2,900 feet (ft) (55 to 884 meters (m)). On Niihau, this species was last seen growing on an exposed basalt ledge at 300 ft (91 m) in elevation. On Lanai, C. pubescens was observed growing among sun-scorched lava rocks along a coastal trail at 50 ft (15 m) elevation with Cordia subcordata (kou) (H. Oppenheimer, PEP Program, pers. comm. 2007). On Maui, C. pubescens is found on recent lava flows in Erythrina (wiliwili) lowland dryland forest and shrubland with the following native species: Capparis sandwichiana (maiapilo), Chamaesyce celastroides var. lorifolia (akoko), Dodonaea viscosa (aalii), Ipomoea spp. (no common name), Morinda spp. (noni), Sida fallax (ilima), Rauvolfia sandwicensis (hao), and Waltheria indica (uhaloa); at elevations between 80 to 400 ft (24 to 122 m) (Wagner and Herbst 1999, p. 654; Hawaii Biodiversity and Mapping Program (HBMP) 2008)."*
>
> *"Currently, Canavalia pubescens is found on the island of Maui (HBMP 2008; H. Oppenheimer, Plant Extinction Prevention Program, pers. comm. 2006; F. Starr, U.S. Geological Survey, Biological Resources Discipline (USGS-BRD), pers. comm. 2006). No plants were observed at the last known location of this species on Lanai in 2007; however, it could possibly be found there again (H. Oppenheimer, pers. comm. 2007). There were a few individuals at Palauea-Keahou, but this area is currently undergoing development (Altenburg 2007, pp. 12-13; H. Oppenheimer, pers. comm. 2007)."*
>
> *"Five populations are known on Maui: Keokea and Puu o Kali with "hundreds" observed; southwest Kalua o Lapa with two individuals; Papaka Kai with six individuals; Ahihi-Kinau with a few individuals; and southeast Pohakea, with at least one individual (HBMP 2008; F. Starr, pers. comm. 2006; H. Oppenheimer, pers. comms. 2006, 2007). These populations total a little over 200 individuals, with the majority ("hundreds") in one population (Puu o Kali)."*

Altenberg (2007), F. Starr (pers. comm.), and H. Oppenheimer (pers. comm.) apparently presumed that the remaining *'āwikiwiki* (*C. pubescens*) at Palauea-Keahou [Honua'ula] have "… likely been destroyed by development" (as cited in USFWS 2008a and 2009). Contrary to this pessimistic outlook, all five individual on the Honua'ula Property continue to thrive. No construction or other development related activity other than recent fence building to keep cattle from the *kiawe-wiliwili* shrubland has been conducted in that area. Honua'ula Partners, LLC is committed to the Maui County Council as early as March 2006 to insure that all five *'āwikiwiki* (*C. pubescens*) plants within the Property are protected and managed to help ensure their conservation.

The Species Assessment and Listing Priority Assignment Form (USFWS 2009) notes that the USFWS has "promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed" and determined that the species "does not appear to be appropriate for emergency listing at this time because the immediacy of

the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process."

Nehe (*Lipochaeta rockii* Sherff) occurs in scattered locations on Maui, but is primarily known from Moloka'i and Kaho'olawe where it is scattered to common in coastal sites to dry forests, and along the margins of lava flows (Wagner et al. 1999). As noted above, *nehe* (*L. rockii*) within the Property have a distinct leaf shape; the leaves are less dissected compared to specimens at other Maui locations. However, it is not recognized as a separate subspecies or variety by botanical authorities (Wagner et al. 1999) and is suggested to easily hybridize with other plants of the same species (Herbst, Bishop Museum, pers. comm.). It is also not given statutory protection by State or Federal laws.

4.1 Comparison to Adjacent Hawaiian Dry Forests and Conservation Efforts

As stated above, there have been no previous efforts to acquire and protect any portion of the Property. Instead, government conservation efforts for native dry forest ecosystems have been focused on better examples of relatively intact ecosystems such as Pu'u o Kali, 'Auwahi, and similar areas. Figure 13 illustrates existing areas on southeastern Maui where remnant dry forest and shrubland communities are being protected by various entities.

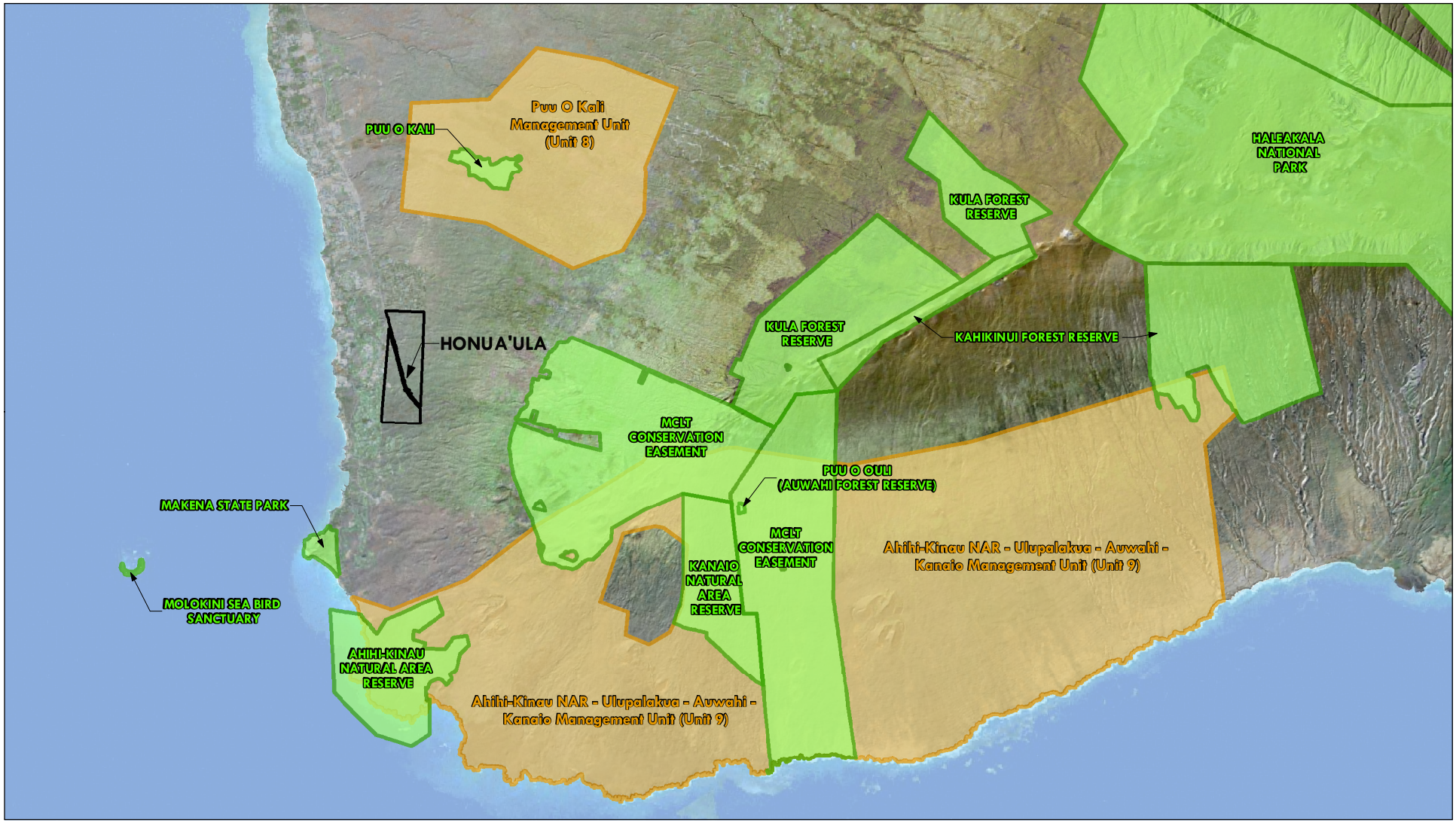
'Auwahi Forest Reserve (Medeiros 2006) is a four hectare (10 ac) remnant native dry forest on the south slope of East Maui at 1,200 m (3,937 ft) elevation (Figure 13). This site has been undergoing restoration since 1997 under a partnership between landowners, government agencies and scientists. 'Auwahi has a rich plant diversity including 50 native tree species, at least five of which are endangered (Medeiros 2006).

Pu'u O Kali Forest Reserve is a remnant *wiliwili* (*E. sandwicensis*) forest on the slopes of east Maui above Kīhei. It is among the most diverse and intact lowland dry forests on Maui which also supports endangered flora. As Monson (2005) quoted A.C. Medeiros, "*Pu'u-O-Kali* is the only place on this whole side that looks like it did in ancient times… It's the only place where a Hawaiian from long ago would look around and say, 'Oh, I know where I am.' They wouldn't recognize the rest of South Maui."

Kanaio Natural Area Reserve located to the south of the Property encompasses 354 ha (876 ac), portions of which include *wiliwili* (*E. sandwicensis*). Nearly 38% of the vegetation in Kanaio is native with about 14% indigenous and 24% endemic. Twenty-two species of Hawaiian dry land forest trees are found in Kanaio, over 35% of the total number of native species in the area (Medeiros et al. 1993).

A relatively pristine remnant native dry forest occurs at Palamanui, a 293 ha (725 ac) mixed use residential and commercial development in Kona, Hawai'i. Sixty two plant species have been described from the native forest there, of which 27 are native and 35 are introduced (Hart 2003). Roughly seven percent of the total Palamanui development parcel consists of a *lama-alahe'e-'iliahi* (*Diospyros-Psydrax-Santalum*) dry forest that has "apparently never received any major disturbance" (Hart 2003, Group 70 International 2004). Three federally listed endangered plant species are found at Palamanui: *uhi-uhi* (*Caesalpinia kavaiensis*), *aiea* (*Nothocestrum breviflorum*) and *halapepe* (*Pleomele hawaiiensis*). Several large 'akoko (*Chamaesyce multiformis*), many of which are larger than have ever been seen before, have been described from Palamanui (Group 70 International 2004).

Another plant mitigation and preserve restoration plan has been developed for construction of The Villages at La'iōpua in Kealakehe, North Kona on the Island of Hawai'i for the Department of Hawaiian Home Lands (Leonard Bisell Associates LLC and Geometrician Associates, 2008). Originally conceived in 1999, the plan addresses the protection of two listed endangered plants: *aupaka* (*Isodendrion pyrifolium*) and *uhiuhi* (*Caesalpinia kavaiensis*) and 19 associated endemic and indigenous plants. Fifty-five species of introduced plant species have been recorded within or near the proposed preserves at La'iōpua. The several small preserves are planned for La'iōpua, the largest of which is 26.6 acres in area. The other preserves are 11 and 4 acres in size, with additional 'mini-preserves' proposed to protect individual trees. As with the proposed Native Plant Preservation Area at Honua'ula, the La'iōpua preserves also incorporate archaeological features, and include specific conservation principals, management objectives, and physical plans.



Legend

- Project Boundary
- Reserves
- Proposed Management Units for the Blackburn's Shpinx Moth

Appendix 1

Figure 13
Vicinity Conservation Efforts

N

0 0.5 1 2 Miles

0 1 2 4 Km

Image Source: State of Hawaii (LANDSAT)
Reserves and Management Units Source: State of Hawaii
Boundary Source: PBR Hawaii

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Protection of at least 22 ha (55 ac) of the dry forest remnant at Palamanui is an integral part of the overall development proposal. Significant elements of the proposed preserve management plan for Palamanui (Hart 2003; J. Price, UH Hilo, pers. comm.) are directly relevant to management of the proposed native plant preserve at Honua'ula and have been incorporated into our recommendations.

4.2 Relevant Dry Forest Research in Hawai'i

In their research studies conducted at Ka'upulehu dry forest on Hawai'i Island, Cabin et al. (2000a) found that excluding ungulates with fencing is effective in helping the recruitment of some native tree species. However, fencing alone was insufficient to restore native dry forests. In another study at Ka'upulehu, Cabin et al. (2002a) experimentally manipulated micro-site conditions (canopy vs. no canopy), water (ambient vs. supplemental), and weeding (removal vs. non-removal). They also added seeds of six native species in 64 1m² plots to investigate the regeneration of native dry forest species. The authors suggest that it is possible to restore degraded dry forests in Hawai'i by manipulating the ecological conditions particularly for the fast growing understory species which then create micro-sites more favorable for the establishment of native trees. Cabin et al. (2002b) investigated how light availability (full vs. 50% shade), alien grass control (bulldoze, herbicide, plastic mulch and trim treatments), and out-planting vs. direct seeding affected the establishment of native plants and suppression of invasive grasses. Their results highlight the fact that restoration can be site specific and hence it is important to examine species and treatment specific responses to these species before attempting large scale conservation efforts. They also suggest that relatively simple techniques can be used to simultaneously suppress invasive grasses and establish populations of vigorous native understory species even at larger scales.

These and other related studies (Allen 2000, Blackmore and Vitousek 2000, Cabin et al. 2000a, 2000b, 2001; Chang 2000, Chimera 2004, Cordell et al. 2001, 2002; D'Antonio et al. 1998, Henderson et al. 2001, Litton et al. 2004, Merlin and Juvik 1992, Sandquist et al. 2004, Stratton 1998, and Tunison 1992) give hope that even small restoration efforts consisting of a few hectares can help provide habitat for rare native dry forest species and can subsequently serve as urgently-needed sources of propagules. This hope is reinforced by the numerous sources on information on successful propagation of rare native Hawaiian plants specifically for landscaping (e.g., Tamimi 1999, Friday 2000, Wong 2003, Bornhorst and Rauch 2003, CTAHR 2006).

5.0 PROPOSED MITIGATION MEASURES

The Maui County Council promulgated 28 specific conditions in granting a Phase I project district zoning approval. Specific conditions related to vegetation within the Property appear in the following paragraphs.

> *"7. That Honua'ula Partners, LLC, its successors and permitted assigns, shall prepare an animal management plan that shall be submitted during Project District Phase II processing and approved by the Department of Land and Natural Resources prior to submittal of Project District Phase III processing. Said plan shall include procedures for the management of animal intrusions including, but not limited to, construction of boundary or perimeter fencing, wildlife control permits, and rodent and feral cat control. Honua'ula Partners, LLC, its successors and permitted assigns, shall implement the approved animal management plan. The Department of Land and Natural Resources may require periodic updates of the plan.*
>
> *27. That Honua'ula Partners, LLC, its successors and permitted assigns, shall provide the report "Remnant Wiliwili Forest Habitat at Wailea 670, Maui, Hawaii by Lee Altenberg, Ph.D.", along with a preservation/mitigation plan, to the State Department of Land and Natural Resources, the United States Fish and Wildlife Service, and the United States Corps of Engineers for review and recommendations prior to Project District Phase 11 approval. The Maui Planning Commission shall consider adoption of the plan prior to Project District Phase II approval.*
>
> *Such plan shall include a minimum preservation standard as follows: That Honua'ula Partners, LLC, its successors and permitted assigns, shall establish in perpetuity a*

Conservation Easement (the "Easement"), entitled "Native Plant Preservation Area", for the conservation of native Hawaiian plants and significant cultural sites in Kīhei-Makena Project District 9 as shown on the attached map. The Easement shall comprise the portion of the property south of latitude 20°40'l 5.00"N, excluding any portions that the State Department of Land and Natural Resources, the United States Fish and Wildlife Service, and the United States Corps of Engineers find do not merit preservation, but shall not be less than 18 acres and shall not exceed 130 acres.

The scope of the Easement shall be set forth in an agreement between Honua'ula Partners, LLC and the County that shall include:

a. A commitment from Honua'ula Partners, LLC, its successors and permitted assigns, to protect and preserve the Easement for the protection of native Hawaiian plants and significant cultural sites worthy of preservation, restoration, and interpretation for public education and enrichment consistent with a Conservation Plan for the Easement developed by Honua'ula Partners, LLC and approved by the State Department of Land and Natural Resources, the United States Geological Survey, and the United States Fish and Wildlife Service; and with a Cultural Resource Preservation Plan, which includes the management and maintenance of the Easement, developed by Honua'ula Partners, LLC and approved by the State Department of Land and Natural Resources (collectively, the "Conservation/Preservation Plans").

b. That Honua'ula Partners, LLC, its successors and permitted assigns, shall agree to confine use of the Easement to activities consistent with the purpose and intent of the Easement.

c. That Honua'ula Partners, LLC, its successors and permitted assigns, shall be prohibited from development in the Easement other than erecting fences, enhancing trails, and constructing structures for the maintenance needed for the area, in accordance with the Conservation/Preservation Plans.

d. That title to the Easement shall be held by Honua'ula Partners, LLC, its successors and permitted assigns, or conveyed to a land trust that holds other conservation easements. Access to the Easement shall be permitted pursuant to an established schedule specified in the Conservation/Preservation Plans to organizations on Maui dedicated to the preservation of native plants, to help restore and perpetuate native species and to engage in needed research activities. These organizations may enter the Easement at reasonable times for cultural and educational purposes only.
e. Honua'ula Partners, LLC, its successors and permitted assigns, shall be allowed to receive all tax benefits allowable under tax laws applicable to the Easement at the time that said Easement is established in Kīhei Makena Project District 9, which will be evidenced by the recordation of the Easement in the Bureau of Conveyances, State of Hawaii."

Active conservation management of any area to be conserved is integral to the long term success of a mitigation effort. Whether the protected area is 80 ha (200 ac) or 5.3 ha (13 ac), there is no guarantee that the best possible conservation efforts and best management practices will perpetually protect all plant species in the same numbers currently found within the Property. However, the immediate concerns for the preserve on the site should be: 1) elimination of browsing, grazing, and trampling pressure on native plants by feral ungulates, 2) removal of noxious invasive plant and animal species, 3) protection against wildland fires. Honua'ula Partners, LLC is proposing to implement the following measures to conserve elements of the remnant *kiawe-wiliwili* shrubland and protect native plants and animals on the Property.

- A conservation easement, hereinafter referred to as "Native Plant Preservation Area", encompassing a contiguous area within the remnant mixed *kiawe-wiliwili* shrubland will be dedicated in perpetuity to protect as much of the remnant native lowland dry shrubland plant community as possible. The protected area will meet the 7.3-52.6 ha (18-130 ac) directive imposed by the Maui County Council, and will ultimately be subject to approval by the Council. The Native Plant Preservation Area will encompass the highest densities of the rarest elements of the native vegetation within the project parcel.

- The development will conserve as many of the *wiliwili* trees (*Erythrina sandwicensis*) as possible outside the Native Plant Preservation Area and elsewhere within the remnant mixed *kiawe-wiliwili* shrubland as possible.

- The entire perimeter of the Property has already been fenced to discourage feral ungulates from entering the *kiawe-wiliwili* shrubland; however, the fence is porous. Fencing requirements will be reviewed and updated as establishment of the Native Plant Preservation Area and site construction begin. An animal management plan will be implemented as soon as possible to ensure that goats, deer, pigs, and stray cattle are removed i*n a humane man*ner from the Property.

- A Natural Resource Manager will be employed by Honua'ula Partners, LLC to help develop and implement specific conservation programs to help ensure the protection of native plants and animals within the Native Plant Preservation Area and other areas designated for native plant protection throughout the Property.

- Honua'ula Partners, LLC will implement a program to control and eradicate invasive grasses, weeds, and other non-native plants from Native Plant Preservation Area ***with the exception of*** the non-native tree tobacco (*Nicotiana glauca*), which is a recognized host plant for the endangered Blackburn's sphinx moth (*Manduca blackburni*).

- Honua'ula Partners, LLC will implement a native plant propagation program for landscaping with plants and seed naturally occurring on the Property. All plants native to the geographic area will be considered as potential species for use in landscaping.

- Honua'ula Partners, LLC will implement a seed predator control program to control rats, mice, and other seed predators within the Native Plant Preservation Area.

- Honua'ula Partners, LLC will implement a fire control program to help protect the Native Plant Preservation Area to help insure the success of plant propagation and conservation efforts.

- Honua'ula Partners, LLC will implement an education and outreach program open to the public at large, and sponsor service groups to assist with implementation of the management programs in the Native Plant Preservation Area and other areas designated for native plant protection.

- Honua'ula Partners, LLC will apply for additional program support offered by the State of Hawai'i (Natural Area Partnership Program and Hawaii Forest Stewardship Program) and U.S. Fish and Wildlife Service to promote sound management of the natural resources on the Property.

- All copies of all SWCA reports prepared for this project, including the Conservation and Stewardship Plan, along with Altenberg (2007) will be submitted to the Department of Land and Natural Resources (DLNR), USFWS, U.S. Geological Survey, and U.S. Army Corps of Engineers for review and comment.

- Long-term vegetation monitoring during wet and dry seasons will be continued to evaluate the health of native plants, and to support the development of the conservation and stewardship plan for the Native Plant Preservation Area and other areas designated for native plant protection.

- Finally, a multi-species Habitat Conservation Plan (HCP), to include the candidate endangered *'āwikiwiki* (*Canavalia pubescens*) is being prepared under Section 10(a)(1)(B) of the Endangered Species Act and in collaboration with DLNR and USFWS.

Taken together with the mitigation measures identified for wildlife (SWCA 2009), these actions fully satisfy the objectives and the intent of the special Project District Phase I conditions promulgated by the Maui County Council and recommendations of State and Federal resources agencies.

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APPENDIX A

CHECKLIST OF PLANTS REPORTED FROM HONUA'ULA

Checklist includes plants reported from Honua'ula by Char and Linney (1988), Char (1993, 2004), Altenberg (2007), and SWCA (this study). Plant names appear alphabetically by family and then by species into each of three groups: Ferns and Fern Allies (Pteridophytes), Monocots, and Dicots. The taxonomy and nomenclature of the flowering plants are based on Wagner et al. (1999), Wagner and Herbst (1999), and Staples and Herbst (2005). Recent name changes are those recorded in the Hawaii Biological Survey series (Evenhuis and Eldredge, eds, 1999-2002). The list includes scientific name with author citation, common English and/or Hawaiian name(s), biogeographic status, and location within the three dominant vegetation types at Honua'ula.

KEY to biographic status:

E = endemic (occurring only in the Hawaiian Islands);
I = indigenous (native to the Hawaiian Islands and elsewhere);
X = introduced or alien (all those plants brought to the Hawaiian Islands after 1778).

KEY to vegetation types:

KB = *kiawe*-buffelgrass grassland;
MG = mixed gulch-vegetation;
KW = mixed *kiawe-wiliwili* shrubland.

KEY to surveys:

C = Char and Linney (1988), Char (1993), Char (2004);
A = Altenberg (2007);
S = SWCA (2008 - this study).

Scientific Name	Common Name	Status	Source Survey	Vegetation Type		
				KB	MG	KW
PTERIDOPHYTES						
Adiantaceae						
Adiantum capillus-veneris L.	maiden-hair fern	I	C		*	
Doryopteris decipiens (Hook.) J. Sm.	*'iwa'iwa*	E	C, A, S	*	*	*
Pellaea ternifolia (Cav.) Link	*pellaea*	I	C		*	*

Scientific Name	Common Name	Status	Source Survey	Vegetation Type		
				KB	MG	KW
Aspleniaceae						
Nephrolepis multiflora (Roxb.) F.M. Jarrett ex. C.V. Morton	sword fern	X	C	*		*
MONOCOTS						
Agavaceae						
Furcraea foetida (L.) Haw.	*malina*	X	S			*
Cannaceae						
Canna indica L.	indian shot	X	C	*		
Commelineaceae						
Commelina benghalensis L.	hairy *honohono*	X	C, S	*	*	*
Commelina diffusa N.L. Burm.	blue day flower	X	C	*	*	
Liliaceae						
Crinum sp.	crinum	X	C	*		
Yucca sp.	yucca	X	C	*		
Poaceae						
Bothriochloa pertusa (L.) A. Camus	hurricane grass	X	C	*	*	
Brachiara subqudripa (Trin.) A.S. Hitchc	brachiara	X	C	*		
Cenchrus ciliaris L.	buffelgrass	X	C, S			*
Cenchrus echinatus L.	sandbur	X	C	*		

Appendix 1

Scientific Name	Common Name	Status	Source Survey	Vegetation Type		
				KB	MG	KW
Chloris barbata (L.) Sw.	swollen finger grass	X	C, S	*	*	*
Chloris radiata (L.) Sw.	plush finger grass	X	C	*	*	*
Cynodon dactylon (L.) Pers	*manienie*	X	C, S	*		*
Digitaria ciliaris (Retz.) Koeler	Henry's crab grass	X	C	*		
Digitaria insularis (L.) Mez ex Ekman	sour grass	X	C, S	*	*	*
Digitaria radicosa (Presl.) Miq.	digitaria	X	C	*		
Digitaria sp.	crab grass	X	C	*		
Eleusine indica (L.) Gaertn.	goose grass	X	C	*	*	*
Eragrostis cilianensis (All.) Vign. ex Janchen	stink grass	X	C	*	*	
Eragrostis tenella (L.) Beauv. ex R. & S.	love grass	X	C	*		
Eragrostis sp.	eragrostis	X	C	*		
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	*pili* grass	E	C, A, S	*	*	*
Panicum maximum L.	guinea grass	X	C, S	*	*	*
Panicum torridum Gaud.	*kakonakona*	E	C			*
Rhynchelytrum repens (Willd.) Hubb.	natal red top	X	C, S			*
Setaria verticillata (L.) P. Beauv.	*mau'u pilipili*	X	C	*	*	*
Tragus berteronianus J.A. Schultes	goat grass	X	C	*	*	*
Urochloa subquadripara (Trin.) R. Webster	signal grass	X	C	*		

Appendix 1

Scientific Name	Common Name	Status	Source Survey	Vegetation Type		
				KB	MG	KW
Zoysia sp.	zoysia	X	C	*		
DICOTS						
Amaranthaceae						
Amaranthus spinosus L.	spiny amaranth	X	C, S	*	*	*
Asclepiadaceae						
Asclepias physocarpa (E.Mey.) Schltr.	balloon plant	X	C, S	*		*
Stapelia gigantea (N.E. Brown)	zulu giant	X	S			*
Asteraceae						
Ageratum conyzoides L.	*maile hohono*	X	C, S	*	*	*
Bidens cynapiifolia Kunth	beggar tick	X	C, S	*	*	*
Bidens pilosa L.	Spanish needle	X	C, S	*	*	*
Calyptocarpus vialis Less.	straggler daisy	X	C, S			*
Centaura melitensis L.	star thistle	X	S			*
Cirsium vulgare (Savi) Ten.	bull thistle	X	S			*
Conyza bonariensis (L.) Cronq.	hairy horseweed	X	C	*		
Conyza canadensis (L.) Cronq.	horseweed	X	C, S	*		*
Crassocephalum crepidioides (Benth.) S.Moore		X	C, S	*	*	*
Emilia fosbergii Nicolson	red *pualele*	X	C	*		*

Appendix 1

Scientific Name	Common Name	Status	Source Survey	Vegetation Type		
				KB	MG	KW
Galinsoga parviflora Cav.		X	C	*	*	
Gnaphalium cf. *japonicum* Thunb.	cudweed	X	C	*	*	
Hypochoeris sp. L.	cat's ear	X	C	*	*	*
Lactuca serriola L.	prickly lettuce	X	C, S			*
Lipochaeta rockii Sherff	*nehe*	E	C, A, S			*
Parthenium hysterophorus L.	false ragweed	X	S			*
Sigesbeckia orientalis L.		X	C	*	*	
Sonchus asper (L.) J. Hill	spiny snowthistle	X	C	*	*	*
Sonchus oleraceus L.	*pualele*	X	C, S	*	*	*
Sphagneticola trilobata (L.) Pruski	wedelia	X	S			*
Synedrella nodiflora (L.) Gaertn.	node weed	X	C	*	*	*
Tridax procumbens L.	coat buttons	X	C, S	*	*	*
Verbesina encelioides (Cav.) Benth. & Hook	golden crown beard	X	C, S	*	*	*
Xanthium strumarium L. var. *canadense* (Miller)	cocklebur	X	C	*	*	*
Zinnia peruviana (L.) L.	wild zinnia	X	C, S	*	*	*
Brassicaceae						
Cornopus didymus (L.) Sm.	wart cress	X	C	*		

Appendix 1

Scientific Name	Common Name	Status	Source Survey	Vegetation Type		
				KB	MG	KW
Cactaceae						
Opuntia ficus-indica (L.) Mill.	*panini*	X	C, S	*	*	*
Pilocereus royenii (L.) Byles & Rowley	Royen's tree cactus	X	S			*
Capparaceae						
Capparis sandwichiana DC.	*maiapilo*	E	C, A, S			*
Cleome gynandra L.	spider flower	X	C	*		*
Caryophyllaceae						
Polycarpon tetraphyllum (L.) L.		X	C	*	*	
Chenopodiaceae						
Chenopodium carinatum R.Br.		X	C, S	*	*	*
Chenopodium murale L.	*aheahea*	X	C, S	*	*	*
Convolvulaceae						
Dichondria repens J. R. & G. Forst.		X	C	*		
Ipomoea indica (J. Burm.) Merr.	*koali awahia*	I	C, A, S	*	*	*
Ipomoea obscura (L.) Ker Gawl.	yellow bindweed	X	C, S	*		
Ipomoea tuboides (Degener & Ooststr.)	Hawaiian moon flower	E	C, A, S			*
Merremia aegyptia (L.) Urb.		X	C, S	*	*	*

Appendix 1

Scientific Name	Common Name	Status	Source Survey	Vegetation Type		
				KB	MG	KW
Cucurbitaceae						
Cucumis dipsaceus (Ehrenb. ex Spach	wild cucumber	X	C, S	*		*
Momordica charantia L.	bitter melon	X	C, S	*	*	*
Sicyos hispidus Hillebr.	*ʻanunu*	E	C, A, S			*
Sicyos pachycarpus Hook. & Arnott	*ʻanunu*	E	A, S			*
Euphorbiaceae						
Chamaesyce celastroides var. lorifolia (A. Gray) Degener & I. Degener	*ʻakoko*	E	A			*
Chamaesyce hirta (L.) Millsp.	hairy spurge	X	C, S	*	*	*
Chamaesyce hypercifolia (L.) Millsp.	graceful spurge	X	C	*		
Euphorbia heterophylla L.	*kaliko*	X	C, S	*	*	*
Phyllanthus tenellus Roxb.		X	C, S	*		
Ricinus communis L.	castor bean	X	C, S	*	*	*
Fabaceae						
Acacia farnesiana (L.) Willd.	klu	X	C, S		*	*
Bauhinia blakeana Dunn	orchid tree	X	C	*		
Calopogonium mucunoides Desv.		X	C			*
Canavalia pubescens Hook. & Arnott	*ʻāwikiwiki*	E	C, A, S			*
Cassia fistula L.	golden shower	X	C	*		

Appendix 1

Scientific Name	Common Name	Status	Source Survey	Vegetation Type		
				KB	MG	KW
Chamaecrista nictitans (L.) Moench	partridge pea	X	C, S	*		*
Crotalaria incana L.	fuzzy rattlepod	X	C	*		
Crotalaria pallida Aiton	smooth rattlepod	X	C	*		
Desmanthus virgatus (L.) Willd.	virgate mimosa	X	C, S	*		*
Desmodium tortuosum (Sw.) DC.	beggar weed	X	C			*
Erythrina sandwicensis O.Deg.	*wiliwili*	E	C, A, S	*	*	*
Indigofera suffritocosa Mill.	*iniko*	X	C, S	*		*
Leucaena leucocephala (Lam.) de Wit	*koa haole*	X	C, S	*	*	*
Macroptilium lathyroides (L.) Urb.	wild bean	X	C, S	*		*
Prosopis pallida (Humb. & Bonpl. Ex Willd.) Kunth	*kiawe*	X	C, S	*	*	*
Samanea saman (Jacq.) Merr	monkey pod	X	C	*		
Senna alata (L.) Roxb	candle bush	X	C	*		
Senna gaudichaudii (Hook. & Arn.) H.S.Irwin & Barneby	*kolomona*	I	C, A, S		*	*
Senna occidentalis (L.) Link	coffee senna	X	C			*
Lamiaceae						
Ocimum basilicum L.	sweet basil	X	C, S	*		*
Ocimum gratissimum L.	basil	X	C, S	*	*	*
Leonotis nepetifolia (L.) R. Br.	lion's ear	X	S			*

Appendix 1

Scientific Name	Common Name	Status	Source Survey	Vegetation Type		
				KB	MG	KW
Stachys arvensis L.	stagger weed	X	C	*	*	*
Malvaceae						
Abutilon grandifolium (Willd.) Sweet	*ma'o*	X	C, S	*	*	*
Abutilon incanum (Link.) Sweet	hoary abutilon	I	C, A, S	*	*	*
Malva parviflora L.	cheese weed	X	C, S	*	*	*
Malvastrum coromandelianum (L.) Garcke	false mallow	X	C	*	*	*
Sida fallax Walp.	*'ilima*	I	C, A, S	*	*	*
Sida rhombifolia L.		X	C	*		
Meliaceae						
Melia azedarach L.	Chinaberry	X	S			*
Moraceae						
Ficus elastica Roxb.ex Hornem	rubber tree	X	C	*		
Ficus microcarpa L. f.	Chinese banyan	X	C, S	*	*	
Myoporaceae						
Myoporum sandwicensis A. Gray	*naio*	E	C, A, S			*
Myrtaceae						
Psidium guajava L.	guava	X	C	*		

Appendix 1

Scientific Name	Common Name	Status	Source Survey	Vegetation Type		
				KB	MG	KW
Nyctaginaceae						
Boerhavia coccinea Mill.		X	C	*		
Boerhavia acutifolia (Choisy) J.W.Moore	*alena*	I	S			*
Boerhavia herbstii Fosb.	*alena*	E	A			*
Boerhavia repens L.	*alena*	I	C, S			*
Mirabilis jalapa L.	four-o' clock	X	C			*
Oxalidaceae						
Oxalis corniculata L.	wood sorrel	X	C, S	*	*	
Papavaraceae						
Argemone glauca (Nutt. Ex Prain (Pope)	*pua kala*	E	A, S			*
Argemone mexicana L.	prickly poppy	X	C, S			*
Bocconia frutescens L.		X	S			*
Eschscholzia californica Cham.	California poppy	X	S			*
Passifloraceae						
Passiflora foetida L.	love-in-a-mist	X	C	*		*
Passiflora subpeltata Ort.	passion flower	X	C, S			*
Plumbaginaceae						
Plumbago zeylanica L.	*'ilie'e*	I	C, A, S	*	*	*

Appendix 1

Scientific Name	Common Name	Status	Source Survey	Vegetation Type		
				KB	MG	KW
Polygonaceae						
Antigonon leptopus H. & A.	coral vine	X	C	*		
Portulacaceae						
Portulaca oleracea L.	pigweed	X	C, S	*	*	*
Portulaca pilosa L.	*ʻakulikuli*	X	C, S	*	*	*
Primulaceae						
Anagallis viscosa L.	scarlet pimpernel	X	C	*	*	*
Sapindaceae						
Dodonaea viscosa Jacq.	*ʻaʻaliʻi*	I	C, A, S			*
Solanaceae						
Capsicum annum L.	chili pepper	X	C, S	*		
Datura stramonium L.	jimson weed	X	C	*	*	*
Lycopersicon pimpinellifolium (Jusl.)	currant tomato	X	C, S	*	*	*
Nicandra physalodes (L.) Gaertn.	apple of Peru	X	C	*	*	*
Nicotiana glauca R.C. Graham	tree tobacco	X	C, S	*	*	*
Solanum americanum Mill.	*popolo*	I	C, S	*	*	*
Solanum seaforthianum Andrews		X	S			*

Appendix 1

Scientific Name	Common Name	Status	Source Survey	Vegetation Type		
				KB	MG	KW
Sterculiaceae						
Waltheria indica L.	*'uhaloa*	I	C, A, S	*	*	*
Tiliaceae						
Triumfetta semitriloba Jacq.	Sacramento bur	X	C, S			*
Verbenaceae						
Lantana camara L.	Sacramento bur	X	C, A, S	*	*	*

Appendix 1

Appendix B

Native Plant Information Sheets

Argemone glauca (Nutt. ex Prain) Pope (Papaveraceae)

Hawaiian Name: *Pua kala*
Status: Endemic

Ecological and Cultural Significance: "Scattered to locally common in coastal dry forest and subalpine forest, 0-1,900 m, on the leeward sides of all of the main islands" (Wagner et al 1999). "Early Hawaiians used the seeds and sap of the stalk as a narcotic and analgesic for toothaches, neuralgia, and ulcers; the sap was used to treat warts" (Wagner et al 1999).

Honua'ula Photos: The majority of *pua kala* clusters occurred in the southwestern portion of the *kiawe-wiliwili* shrubland, usually in relatively open sunny locations of the lava flow. All plants we observed were flowering at the time of the surveys.

Distribution and Density at Honua'ula: We found 412 *pua kala* (*Argemone glauca*) in 26 locations within the Property. Most clusters averaged 16 individuals, most of which were seedlings (60%). Canopy cover of *pua kala* clusters ranged from one to 39 m^2 with the average being 4 m^2 (n= 26 clusters).

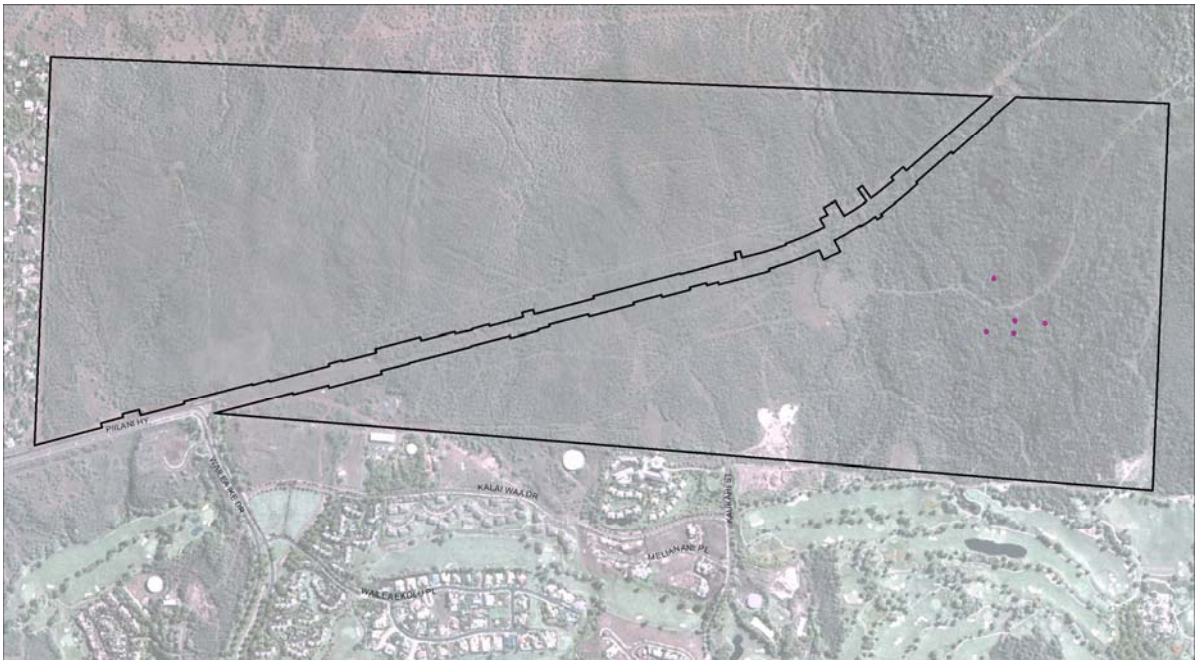
Canavalia pubescens Hook. & Arnott (Fabaceae)

Hawaiian Name: *'Āwikiwiki*
Status: Endemic (Candidate Endangered Species)

Ecological and Cultural Significance: "Presently uncommon in open dry sites such as lava fields, kiawe thickets, and dry forest, 15-540m, on Ni'ihau, Kaua'i (Nāpali Coast), Lāna'i, and leeward East Maui" (Wagner et al 1999). "Five populations are known on Maui: Keokea and Puu o Kali with "hundreds" observed, southwest Kalua o Lapa with two individuals, Papaka Kai with six individuals, Ahihi-Kinau with a few individuals, and southeast Pohakea, with at least one individual (HBMP 2008; F. Starr, pers. comm. 2006; H. Oppenheimer, pers. comm. 2006, 2008). These populations total a little over 200 individuals, with the majority ("hundreds") in one population (Puu o Kali)" (USFWS 2009).

Honua'ula Photos: All five *'āwikiwiki* were flowering and fruiting at the time of the survey; however, no seedlings were detected. The plants appeared to be healthy with no signs of damage or disease.

Distribution and Density at Honua'ula: Altenberg (2007) illustrated GPS points for some 15 plants within the development. During this intensive field survey, however, SWCA's project botanists found only five *'āwikiwiki* plants.



Capparis sandwichiana DC (Capparaceae)

Hawaiian Name: *Maiapilo*
Status: Endemic

Ecological and Cultural Significance: "Scattered on coral, basaltic rocks, or in soil along the coast or somewhat inland, 0-100 (-575) m, on Midway Atoll, Pearl and Hermes Atoll, Laysan, and all of the main islands" (Wagner et al 1999).

Honua'ula Photos: Several *maiapilo* clusters were flowering and fruiting but the frequency of seedlings was low (2.5%). About 20% of the plants showed mild to heavy signs of insect herbivory where the epidermis (upper layer of the leaves) appeared to be scrapped away.

Distribution and Density at Honua'ula: *Maiapilo* (*Capparis sandwichiana*) is a common shrub throughout the understory of mixed *kiawe-wiliwili* shrubland. We found 563 *maiapilo* during the survey and all but one individual was limited to the southern 'a'ā lava flow. Most clusters ranged from one to five individuals; 11 were larger, consisting of six to 10 individuals. The aerial cover of the largest cluster was 531 m^2, others ranged from one to 314 m^2 (average cover of 17 m^2).

Dodonaea viscosa Jacq. (Sapindaceae)

Hawaiian Name: *'A'ali'i*
Status: Indigenous

Ecological and Cultural Significance: "Pantropical; in Hawaii scattered to dominant, often in open sites such as ridges and lava fields, sometimes successional on lava or in pastures, ranging from coastal dunes, low elevation shrubland communities to dry, mesic, and wet forest, also subalpine shrubland, 3-2,350 m, on all of the main islands except Kaho'olawe" (Wagner et al 1999). "An extremely polymorphic species…Both the breeding system and morphological features of the *Dodonaea viscosa* complex are polymorphic" (Wagner et al 1999). "The fruit and leaves of *Dodonaea* are popular in lei making" (Wagner at al 1999).

Photos: One *'a'ali'i* plant was observed fruiting, and no seedlings were observed in the vicinity of the adult shrubs. All plants were healthy with no detectable signs of damage, disease or herbivory.

Both photos by Forest & Kim Starr (www.hear.org)

Left: *'a'ali'i flowers from Kanaio, Maui*

Right: 'a'ali'i near Auwahi, Maui

Distribution and Density at Honua'ula: We observed 16 *'a'ali'i* in seven locations, all limited to the south western corner of the *kiawe-wiliwili* shrubland. Six of the seven locations had one to four individuals while the largest cluster comprised of six individuals. Average cover of *'a'ali'i* is about 26 m^2 where the aerial cover of two clusters were 79 m^2 each and the remaining five ranged from one to 20 m^2.

Doryopteris decipiens (Hook.) J. Sm. (Pteridaceae)

Hawaiian Name: *Iwaiwa*
Status: Endemic

Ecological and Cultural Significance: Reported from all major Hawaiian Islands and Ni'ihau, Lehua, and Kaho'olawe" (Palmer 2003). "Common in dry shrublands, grasslands and forests, often growing on exposed basalt, 30-915 m" (Palmer 2003).

Honua'ula Photos: Some iwaiwa plants within the development area showed signs of dehydration; most plants in the largest cluster (16 individuals) were very dry.

Distribution and Density at Honua'ula: Fifty-four *Iwaiwa* (*Doryopteris decipiens*) ferns were distributed at about 14 locations within the Property. Of these seven ferns were found within the *kiawe-wiliwili* shrubland, the others in the drainage gulches within in the northern portion of the site. The number of individuals within a cluster ranged from one to 16, the majority of which were adults (96%). Aerial cover of the largest cluster was approximately 7 m^2 while the others ranged from one to 3 m^2.

Erythrina sandwicensis Degener (Fabaceae)

Hawaiian Name: *Wiliwili*
Status: Endemic

Ecological and Cultural Significance: "Locally common in dry forest, up to 600m, on leeward slopes of all the main islands". "The soft, light wood was and still is used for the outriggers of traditional Hawaiian canoes. It also was formerly used for fishnet floats and surfboards. The seeds are strung into lei." Wagner et al (1999)

Honua'ula Photos: Most wiliwili trees showed some form of damage, primarily from the Erythrina gall wasp (*Quadristichus erythrinae* Kim) and the seed eating bruchid beetle (*Specularius impressithorax* Pic). Many trees were flush with new leaves following heavy rains in the spring of 2008, suggesting recovery from gall wasp damage.

Distribution and Density at Honua'ula: Wiliwili (*Erythrina sandwicensis*) is the most common native tree species in the *kiawe-wiliwili* shrubland. We mapped a total of 2478 individuals of which 2439 occurred in the southern 'a'ā portion of the Property in groves of various sizes. The largest groves (>15 individuals) tended to be located in the eastern portion of the kiawe-wiliwili shrubland. The frequency of adult wiliwili trees was greater (86%) than seedlings and juveniles.

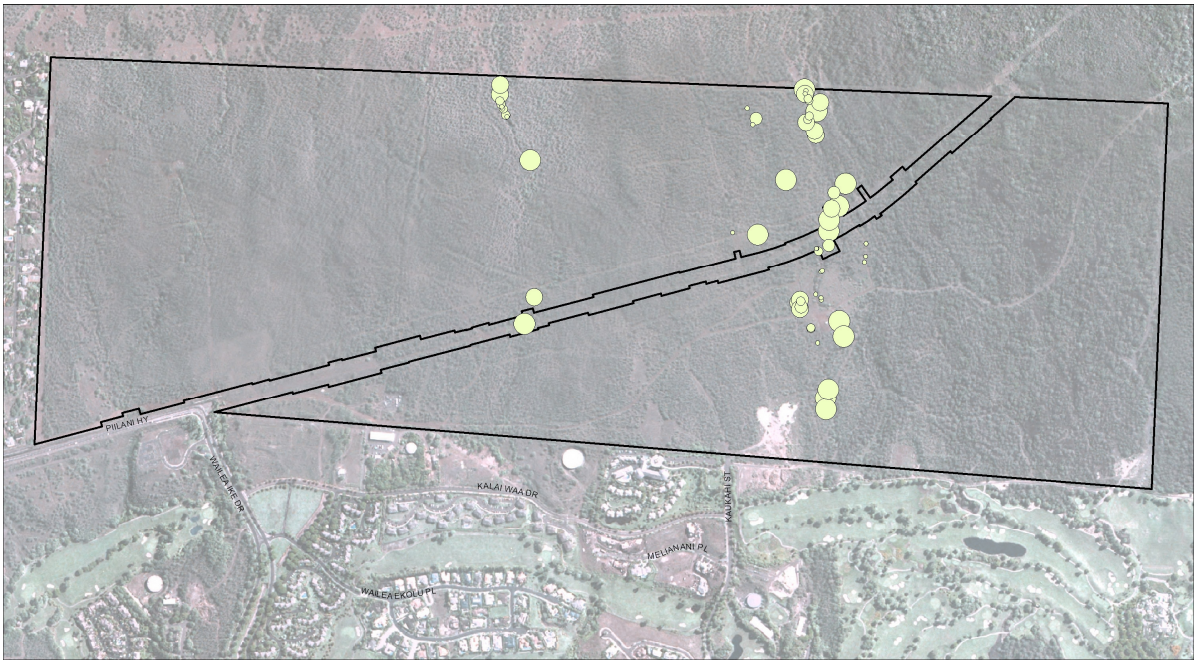
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult. (Poaceae)

Hawaiian Name: *Pili* grass
Status: Indigenous

Ecological and Cultural Significance: "Widely distributed throughout the tropics; in Hawai'i indigenous or possibly a Polynesian introduction, occurring on dry rocky cliffs, ledges, or slopes close to ocean exposure, 0-700 m, on all the main islands" (Wagner et al 1999). In dryer places, *pili* was favored for thatching material because of its pleasant odor, and was often used under a finishing thatch of *tī*, *hala*, or *kō* (Abbott 1992).

Honua'ula Photos: *Pili* grass (*Heteropogon contortus*) was the only native grass species found within the project area. Adult plants were flowering at the time of our surveys. We did not observe signs of superficial damage or disease.

Distribution and Density at Honua'ula: *Pili* grass was limited to gulches within the kiawe-buffel grass grassland in the northern half of the Project site. Most of *pili* grass occurred in the southern drainage gullies of the grassland, becoming less abundant to the north. We mapped 1493 *pili* grass plants in 66 locations within the Property.



Ipomoea tuboides Degener & Ooststr. (Convolvulaceae)

Hawaiian Name: Hawaiian Moon Flower
Status: Endemic

Ecological and Cultural Significance: "Occurring on arid rocky talus slopes or aa lava, 0-610 m, on all of the main islands" (Wagner et al 1999).

Honua'ula Photos: At the time of the SWCA 2008 surveys, all the Hawaiian moon flower plants within the development were flowering.

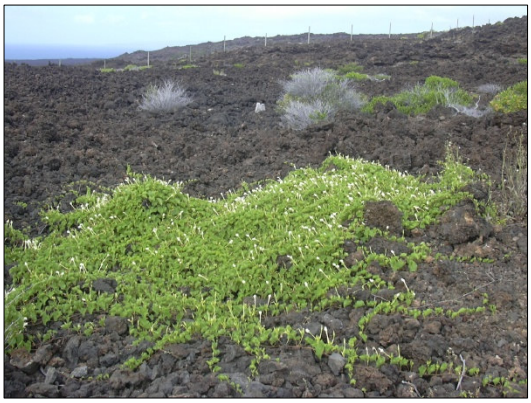


Photo above by Forest & Kim Starr of *Ipomoea tuboides* at Kanaio, Maui. (www.hear.org).

Distribution and Density at Honua'ula: Five Hawaiian moon flower (*Ipomoea tuboides*) vines were observed within the southern 'a'ā portion of the Property .

Lipochaeta rockii Sherff (Asteraceae)

Hawaiian Name: *Nehe*
Status: Endemic

Ecological and Cultural Significance: "Scattered to common in coastal sites to dry forest, often in disturbed areas and margins of lava flows, 15-550m, on Moloka'i, from scattered localities on Maui, common the coast on Kaho'olawe, also a single collection presumably from Hawai'i" (Wagner et al 1999). Synonymous with *L. lobata* (Gaud.) DC var. *makenensis* Degener & Sherff, *L. rockii* today is not recognized as a separate variety or subspecies (Herbst, Bishop Museum, pers. comm.)

Honua'ula Photos: The population of nehe within the Honua'ula project area has a unique leaf shape.

Distribution and Density at Honua'ula: One hundred and one *nehe* (*Lipochaeta rockii*) were found distributed in 24 locations. Two large clusters contained 22 and 23 individuals respectively and were located in the center of the mixed *kiawe-wiliwili* shrubland. Smaller clusters (< 10 individuals) were found from central to southwestern portion of the shrubland. The aerial cover of clusters ranged from < 1 m^2 to 78.5 m^2.

Myoporum sandwicense A. Gray (Myoporaceae)

Hawaiian Name: *Naio*
Status: Indigenous

Ecological and Cultural Significance: "Occurring on Mangaia in the Cook Islands and Hawai'i; in Hawai'i, occasional to common in strand vegetation, dry forest, 'a'ā lava, mesic to wet forest, and a dominant element of subalpine forest, 0-2,380 m, probably on all of the main islands but not documented from Kaho'olawe" (Wagner et al 1999). "The wood, while drying or burning, has an odor similar to that of sandalwood. It was once shipped to China as a substitute after the local sandalwood supply was exhausted, but it was not accepted. Also,it formerly was a preferred wood for house frames" (Wagner et al 1999).

Honua'ula Photos:

Distribution and Density at Honua'ula: Twenty one *naio* (*Myoporum sandwicense*) trees were observed in 17 locations distributed throughout the southern portion of the *kiawe-wiliwili* shrubland. No *naio* seedlings were found. Fifteen of the 17 locations were occupied by a single tree. Aerial cover ranged from < 1 m^2 to 78.5 m^2, the largest of which consisted of three trees.

Senna gaudichaudii (Hook. & Arnott) H. Irwin & Barneby (Fabaceae)

Hawaiian Name: *Kolomona, uhiuhi*
Status: Indigenous

Ecological and Cultural Significance: "Occurring in the Pacific Basin, including the New Hebrides, Austral Islands, Rapa, Henderson Island, Fiji, Hawai'i, and perhaps New Caledonia and Tahiti; in Hawai'i primarily occurring in leeward sites usually on talus slopes, lava flows, or rocky sites in coastal *Leucaena-Prosopis* shrubland, disturbed hala forest, dry forest, and occasionally lower portions of mesic forest, 5-920 m, documented from all of the main islands except Ni'ihau and Kaho'olawe" (Wagner et al 1999).

Honua'ula Photos: Evidence of herbivory was observed at four of 32 locations. Many of the plants found were flowering and / or fruiting at the time of our surveys.

Distribution and Density at Honua'ula: Thirty-nine *kolomona* (*Senna gaudichaudii*) trees were mapped at 32 locations within the Property. Most were distributed in the southern portion of the mixed *kiawe-wiliwili* shrubland. The cluster size ranged from one to five individuals, and 24 of 32 mapped locations consisted of solitary plants. The aerial cover ranged from < 1 m^2 to 19.6 m^2.

Sicyos hispidus Hillebr. (Cucurbitaceae)

Hawaiian Name: *ʻĀnunu*
Status: Endemic

Ecological and Cultural Significance: "Occurring in dry forest or alien vegetation, from near sea level up to 800 m, on Molokaʻi, Lānaʻi, Maui in the valley area from Kahului and Kīhei, and Hawaiʻi in the North Kona area" (Wagner et al 1999).

Honuaʻula Photos: *ʻĀnunu* vines within the Property did not show any signs of damage or herbivory.

Distribution and Density at Honuaʻula: We mapped 113 *ʻānunu* (*Sicyos hispidus*) vines at 49 locations within the Property. *ʻĀnunu* occurred primarily in the central and northern edge of the *kiawe-wiliwili* shrubland. Larger clusters (> 5 individuals) tended to be located in the central portion of the *kiawe-wiliwili* shrubland.

Sicyos pachycarpus Hook. & Arnott (Cucurbitaceae)

Hawaiian Name: *'ānunu*
Status: Endemic

Ecological and Cultural Significance: "Widespread in herb or shrubland coastal communities, dry forest, and alien vegetation such as *Leucaena* or *Prosopis* shrubland, on coral sand and clay loam, 0-900 m, primarily on the lower leeward slops of all the main islands; also on the Northwestern Hawaiian Islands where collected from Laysan and Nihoa" (Wagner et al 1999).

Honua'ula Photos: Approximately 52% of mapped plants were seedlings. Many adults were observed flowering and/ or fruiting. Most of the *'ānunu* vines appeared to be healthy with only one plant showing some signs of herbivory.

Distribution and Density at Honua'ula: Six hundred and three *S. pachycarpus* were mapped in 102 locations. The size of clusters varied greatly and ranged from one to 110 plants per location. The majority of the larger clusters (> 15 individuals) were concentrated in the south and central portions of the *kiawe-wiliwili* shrubland.

Appendix 2

Appendix 2

Wildlife Survey of Honua'ula (Wailea 670) Kīhei, Maui

Prepared for

Honua'ula Partners, LLC
381 Huku Li'i Place, Suite 202
Kīhei, Maui 96753

Prepared by

SWCA Environmental Consultants
201 Merchant Street Suite 2310
Honolulu, HI 96813

January 2009
Updated February 2010

Appendix 2

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1.0 BACKGROUND AND PURPOSE OF THE STUDY

SWCA Environmental Consultants (SWCA) was tasked to conduct botanical and wildlife surveys within the 271 hectare (ha) or 670 acre (ac) Honua'ula (Wailea 670) Property (hereinafter referred to as the 'Property') in Kīhei, Maui. This report documents the results of the wildlife surveys conducted by SWCA within the Property. Specific objectives include documenting the presence and relative abundance of birds, mammals, amphibians, and reptiles at the Property; and, determining the presence and abundance of any protected species including migratory shorebirds, waterbirds, federally and state listed endangered or threatened species, and 'species of concern'.

The study supplements prior surveys of the same parcel by Bruner (1988, 1993, and 2004), and satisfies Condition 9 of the Maui County Council for Project District II Zoning approval. This report also satisfies the requirements of Hawai'i Revised Statutes Chapter 343 for description of natural resources, and will be cited in the Environmental Impact Statement (EIS) being prepared for Honua'ula. A companion document addressing vegetation issues was prepared by SWCA and is being submitted under separate cover (SWCA 2009).

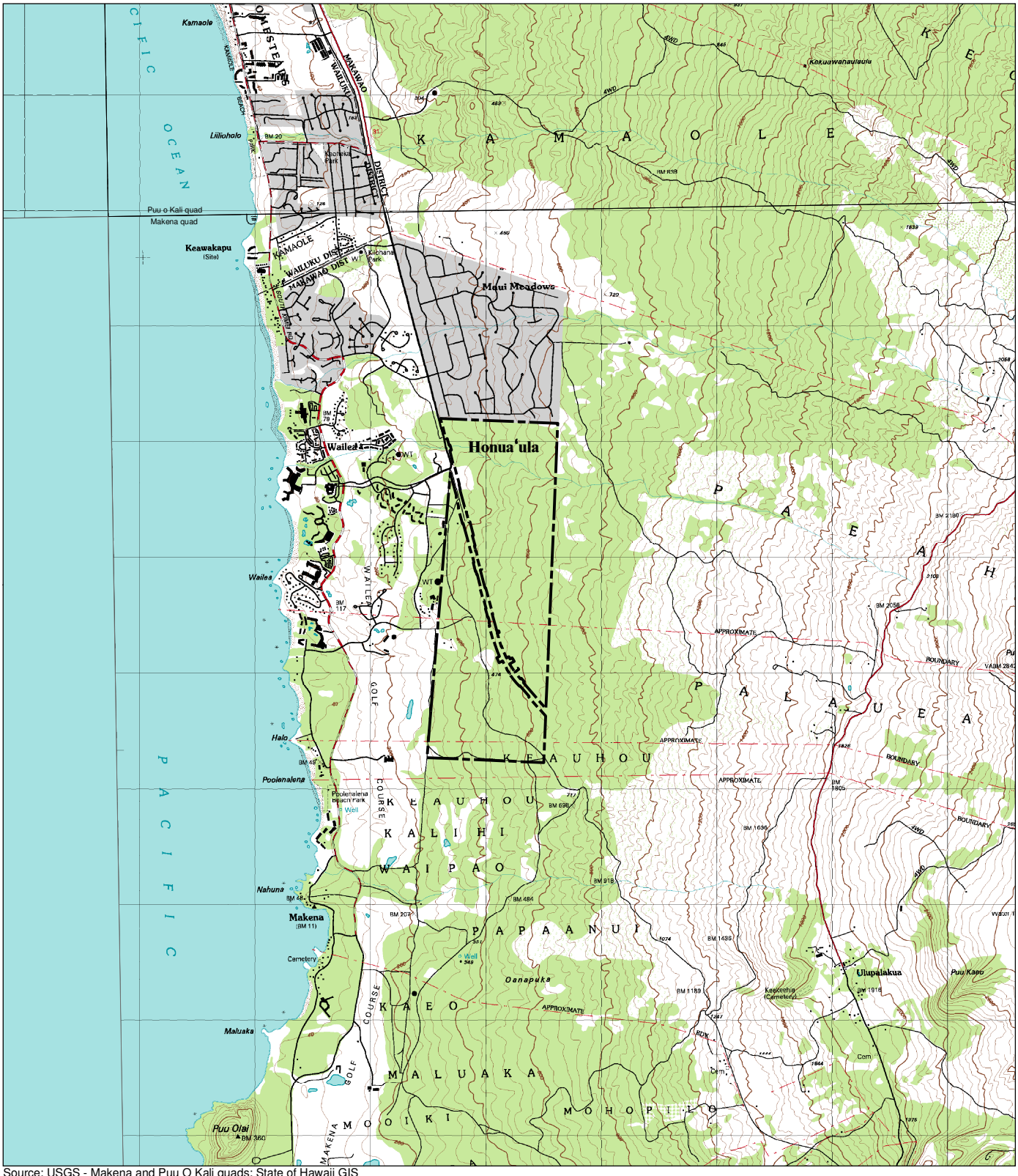
This report was authored by Ling Ong, Ph.D., Stephen M. Mosher, M.S., Tiffany Thair, (M.S. candidate), and Ryan Taira, B.A. of SWCA. Peer review was provided by Michelle Christy, Ph.D. and John Ford, M.S. of SWCA. Field work was conducted by Dr. Ong and Mr. Mosher with assistance from Dr. David Preston of the Bishop Museum Department of Entomology, Betsy Gagne of the Natural Area Reserve System, Hawai'i Department of Land and Natural Resources-Division of Forestry and Wildlife (DLNR-DOFAW), and biologist James Kwon of the U.S. Fish and Wildlife Service (USFWS) Division of Ecological Services, Honolulu.

2.0 DESCRIPTION OF THE PROPERTY

Honua'ula (Wailea 670) encompasses 270 ha (670 ac) on the southeastern slope of Mt. Haleakalā, Maui, between approximately 89 m (290 ft) and 220 m (720 ft) elevation (Figure 1). Approximately 200 ha (500 ac) in the northern portion of the parcel is underlain by older lavas of the Kula Volcanic Series. The remaining 70 ha (170 ac) on the south side of the Property is underlain by relatively younger Hana Volcanic Series lavas. This area is characterized by an extremely rough surface composed of broken 'a'ā lava. Weathering led to the formation of a thin layer of soil over the northern 200 ha, but since the southern portion is derived from younger volcanic eruptions, less weathering of the 'a'ā in this region has led to presence of little or no soil (PBR Hawaii 1988).

Twenty-six (26) native plant species and 120 non-native plant species were described by SWCA (2009) and other investigators in three distinct vegetation types that provide habitat for wildlife within the Property (Figure 2). The three vegetation types within the Property are the *kiawe*-buffelgrass (*Prosopis pallida-Cenchrus ciliaris*) grassland, mixed gulch vegetation, and remnant mixed *kiawe-wiliwili* (*Prosopis pallida-Erythrina sandwicensis*) shrubland. About 75% of the northern portion of the Property is characterized by an extensive grassland comprised primarily of *kiawe* (*Prosopis pallida*) *and* buffelgrass (*Cenchrus ciliaris*).. The *kiawe*-buffelgrass grassland is bisected from east to west by several gulches that carry flood waters to the sea. The gulch vegetation is comprised of various species of ferns, native *Pili* grass (*Heteropogon contortus*), and other species. The third vegetation type is limited to the 'a'ā lava flow in the southern quarter of Property and consists of scattered groves of large-stature *wiliwili* (*Erythrina sandwicensis*) and co-dominant *kiawe* trees (*P. pallida*) (SWCA 2009).

Axis deer (Axis axis) and feral goats (Capra hircus hircus) have had unrestricted access throughout the Property and pose a serious threat to native plant species and to the integrity of the remnant mixed kiawe-wiliwili shrubland. Many of the wiliwili trees on the Property have been recently infested by the invasive gall wasp (Quadratichus erythrinae) which also threatens the entire ecosystem. Historically, the Property has been exposed to cattle grazing.



Source: USGS - Makena and Puu O Kali quads; State of Hawaii GIS

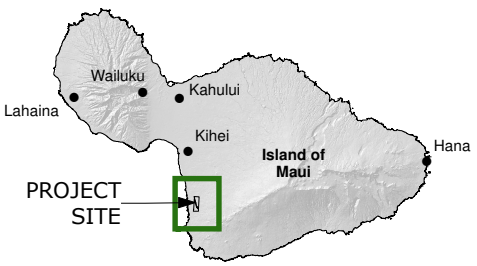


Figure 1
Location Map

N

0 1,000 2,000 4,000 ft

0 250 500 1,000 M

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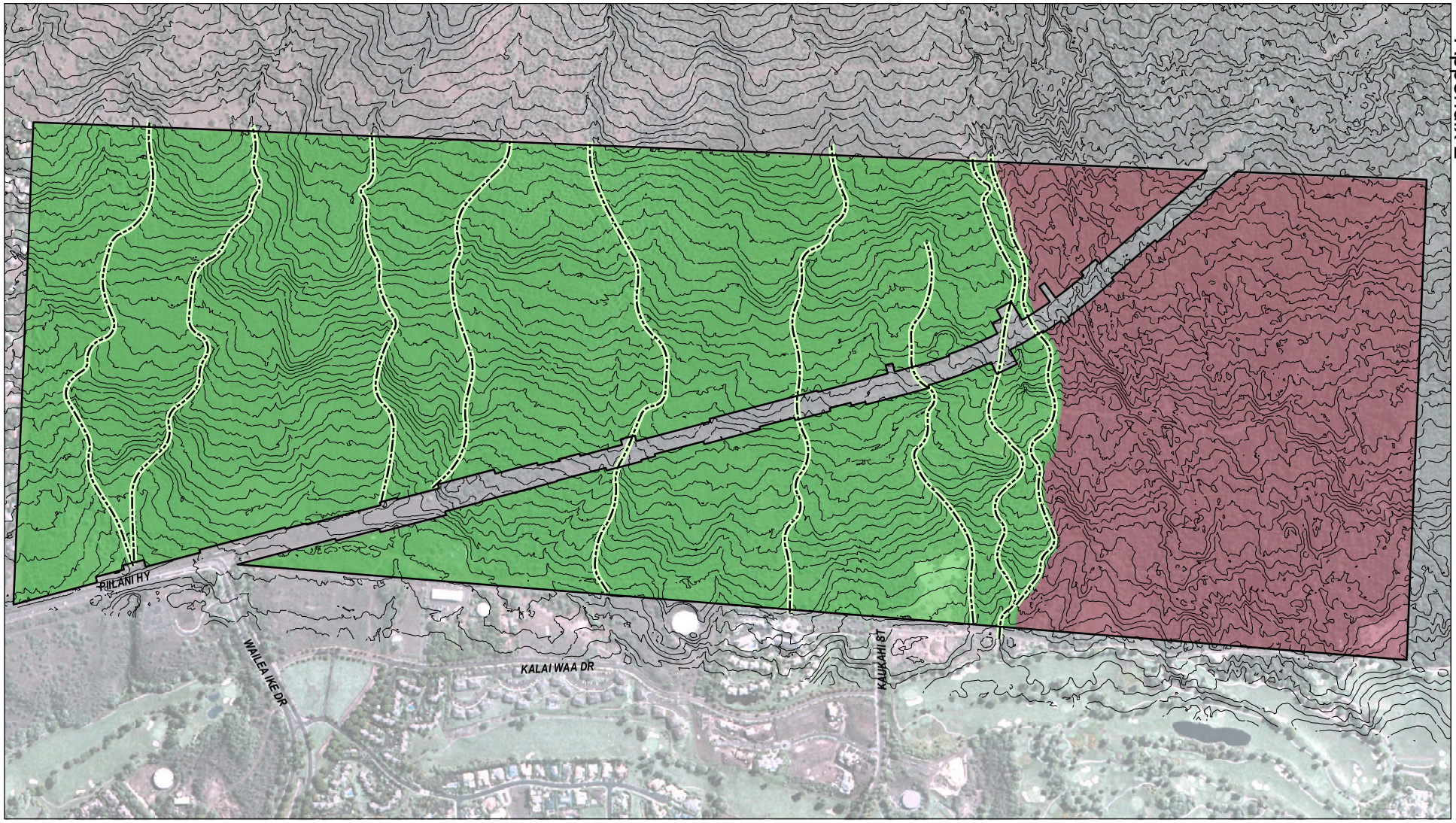

Legend
- Project Boundary

Vegetation Types
- Kiawe-buffel Grass Grassland
- Kiawe-wiliwili Shrubland
- Mixed Gully, Kiawe-Guinea Grass Vegetation

Boundary Source: PBR Hawaii
Aerial Source: PDC (Pacific Disaster Center)

Figure 2
Vegetation Types

0 250 500 1,000 ft
0 50 100 200 M
N

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Small portions of the northern *kiawe*-buffelgrass grassland are infrequently grazed by cattle belonging to 'Ulupalakua Ranch under agreement with Honua'ula Partners, LLC. Honua'ula Partners, LLC constructed a cattle fence bisecting the parcel to prevent cattle from entering the remnant *kiawe-wiliwili* shrubland in the southern portion of the Property. There is no evidence of other agricultural activity having occurred previously (PBR Hawaii 1988); however, the area was used during the Second World War as a training and maneuver area for armored vehicles (Erdman, Ulupalakua Ranch, pers. comm.).

3.0 METHODS OF STUDY

SWCA initially conducted a literature review of natural resources within the region that encompasses the Property, and considered the comments and concerns expressed by resource agencies and the Maui County Council in prior correspondence.

3.1 Avian Survey Methods

Point count surveys were conducted by SWCA biologists Ling Ong, Ph.D. and Stephen Mosher, M.S. on May 27-29 and September 19-21, 2008. Twenty-eight (28) point count stations were established throughout the Property in all habitat types (Figure 3). The location of each point count site was confirmed with a GPS receiver and two observers were present at each point count. Visual observations of birds were conducted with 10 x 50 binoculars with a 6.5 degree field of vision; and aural observations were also conducted by listening for vocalizations.

The relative densities of species were estimated using five-minute 200 m (656 ft) radius point counts conducted during peak bird activity periods (0600 - 1100 and 1600 - 1900). Five minute point counts maximized the likelihood of detecting new species during the survey (Lynch 1995). Bird density data and species composition from the study were compared with the findings of Bruner (1988, 1993, and 2004). Mammals and reptiles seen or heard during the point count surveys were also recorded as incidental sightings. Rare or previously unrecorded bird, mammal, reptile, or amphibian species seen between count stations were also noted.

Line transect surveys were conducted by SWCA biologists Ling Ong, Ph.D. and Stephen Mosher, M.S. from September 19-21, 2008 to determine the presence and density of the two owl species known to inhabit the Property: the barn owl (*Tyto alba*) and the Hawaiian short-eared owl or pueo (*Asio flammeus sandwichensis*) (Figure 4). Twelve transects between 900-1000 m (2,952-3,280 ft) long were oriented east-west across the entire length of the parcel. These transects were at least 250 m (820 ft) apart. An additional eight transects of 250 m (820 ft) were oriented north-south at the eastern and western boundaries of the property. Total transect length in *kiawe*-buffelgrass grassland habitat was 8.6 kilometers (5.4 miles), and 5.0 kilometers (3.1 miles) in the remnant *kiawe-wiliwili* shrubland portion of the Property.

Two observers were present on each transect survey. Owls observed along transects were identified to species and recorded, along with perpendicular distance between transect and owl. The density of owls present on site was calculated using the DISTANCE 5.0 program. As the resulting sample size was small, data from both species were pooled to obtain a combined owl density. Pueo densities were calculated by determining the ratio of pueo to barn owl sightings and adjusting the calculated owl density from the DISTANCE 5.0 program proportionately. Due to habitat differences, owl densities within the *kiawe*-buffelgrass area were analyzed separately from the remnant *kiawe-wiliwili* shrubland habitat.

3.2 Nocturnal Surveys for Hawaiian Hoary Bats

Surveys for endangered Hawaiian hoary bats (*Lasiurus cinereus semotus*) were conducted at the Property between 1830 and 0000 from September 19-21, 2008 by SWCA biologists Dr. Ling Ong and Stephen Mosher. These surveys were conducted under ideal weather conditions using night vision goggles (Morovison PVS-7 Ultra) and an Anabat detector (Titley Electronics, NSW Australia).

Anabat detectors assist in the identification of bats by recording their echolocation calls. The device also produces real-time audible output for humans to hear of the ultrasonic sounds the bat generates. Bat point count stations were established at 14 locations at least 400 m (1,312 ft) apart on jeep roads within the Property, and surveyed for five minutes each (Figure 3). The detection distance for bats using night vision goggles was estimated to be 30 m (98 ft) radius at each point count station.

3.3 Surveys for the Blackburn's Sphinx Moth

Surveys for endangered Blackburn's sphinx moths (*Manduca blackburni*) were conducted within the Property on March 13, 2008, May 27-29, 2008, and November 11, 2008. The March and May surveys were conducted by Bishop Museum entomologist David Preston, Ph.D. and Betsy Gagné, M.S. of the Hawai'i Division of Forestry and Wildlife, accompanied by SWCA biologist John Ford, M.S. Dr. Preston and Ms. Gagné were accompanied by biologist James Kwon of the USFWS. These surveys focused on host plants used by the various life stages of Blackburn's sphinx moth (*Manduca blackburni*) that are known to occur within the Property. Leaves and stems were examined carefully for the presence or sign of moths, including frass (fecal matter), cut stems and leaves, and eggs.

4.0 RESULTS

4.1 Endangered Species

Although not detected during pervious wildlife surveys by Bruner (1988, 1993 and 2004), endangered Blackburn's sphinx moth (*Manduca blackburni*) caterpillars and sign, as well as a single endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), were found within the Property during this study. Details of the sightings are presented in the following sections.

4.1.1 Blackburn's Sphinx Moth (*Manduca blackburni*)

The Blackburn's sphinx moth (Family: Sphingidae) was listed as federally endangered in February 2000 and was the first Hawaiian insect to be listed as an endangered species. It is the largest native insect in Hawai'i, with a wing span of up to 120 millimeters (5 inches) and long, narrow forewings (Figure 5). It is primarily grayish brown, with black bands across the top margins of the hind wings and five orange spots along each side of the abdomen. The body is thick and spindle shaped, tapering at both ends (USFWS 2003, Black 2005, and USFWS 2005). The caterpillar has two color morphs: bright green (Figures 6) or gray. White speckles are scattered throughout the caterpillar's back and a horizontal white stripe is present on the side of each segment (Black 2005). Characteristic of other hornworms, the caterpillar has a horn-like protrusion on the last abdominal segment (USFWS 2005). The species is often confused with the non-native potato hornworm (*Agrius cingulata*) which has also been recorded in the Hawaiian Islands.

The Maui Nui Recovery Unit for the Blackburn's sphinx moth consists of seven management units comprising approximately 22,788 ha (56,305 ac; USFWS 2002, 2003, 2005). Of these, approximately 45,867 ha (18,564 ac) located in four units are on Maui. The closest management units to the Property are Pu'u O Kali (Unit 8) and the Ahihi-Kinau NAR – Ulupalakua – Auwahi – Kanaio Management Unit (Unit 9), located roughly 2.5 and 4 km (1.6 and 2.5 miles) from the Property, respectively (Figure 7).

On March 13, 2008 in the early afternoon, Dr. Preston found a small Blackburn's sphinx moth caterpillar feeding on leaves of a non-native tree tobacco (*Nicotiana glauca*) in the southeastern corner of the Property (Figure 8). On that same day, he found evidence of feeding (cut stems and leaves, and the presence of frass) by Blackburn's sphinx moth caterpillars on tree tobacco plants at numerous other locations within the Property (Figure 10), and recorded the location of each with a GPS receiver. No Blackburn's sphinx moth caterpillars were recorded during the May survey, however, grazing damage was evident and recorded (Figure 10).

Appendix 2

Legend

- Project Boundary
- Bird Count Points May 29, 2008
- Bird Count Points Sept 19-21, 2008
- Bat Point Counts Sept 19-20, 2008

Vegetation Types

- Kiawe-buffel Grass Grassland
- Kiawe-wiliwili Shrubland
- Mixed Gully, Kiawe-Guinea Grass Vegetation

Figure 3
Bird and Bat Point Count Stations

N

0 250 500 1,000 ft

0 50 100 200 M

Boundary Source: PBR Hawaii
Aerial Source: PDC (Pacific Disaster Center)

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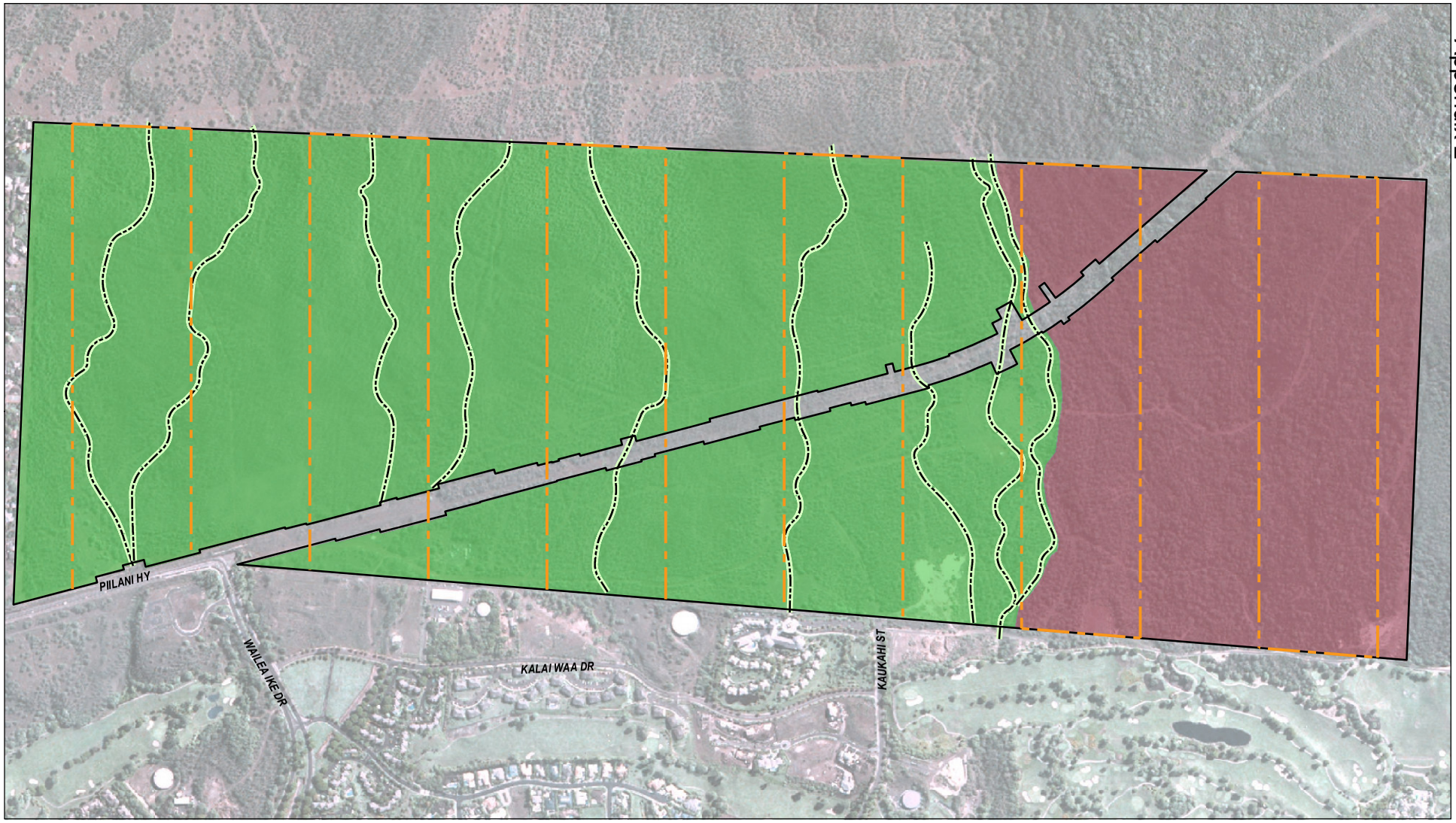
Appendix 2



Legend

Project Boundary

Transect

Vegetation Types

Kiawe-buffel Grass Grassland

Kiawe-wiliwili Shrubland

Mixed Gully, Kiawe-Guinea Grass Vegetation

Figure 4
Pueo Transects

0 250 500 1,000 ft

0 50 100 200 M

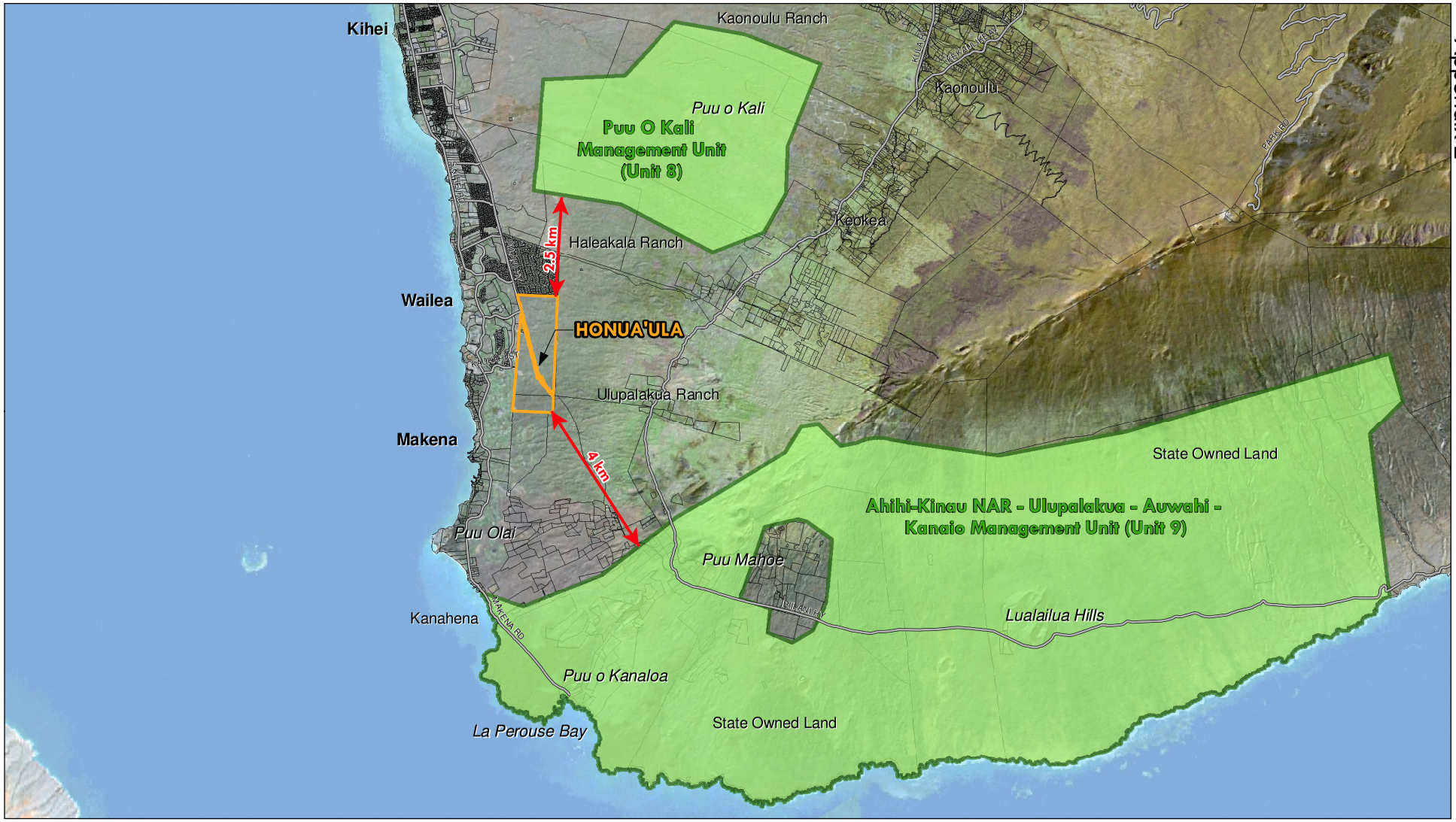
N

Boundary Source: PBR Hawaii
Aerial Source: Pacific Disaster Center (PDC)

SWCA ENVIRONMENTAL CONSULTANTS

**Figure 5. An adult endangered Blackburn's sphinx moth.
Photo by W.P. Mull.**

Figure 6. This large green morph caterpillar of *M. blackburni* was photographed at Honua'ula on November 11, 2008 by SWCA staff.



Legend
- Project Boundary
- Management Units

Figure 7
Management Units for Blackburn's Sphinx Moth in South Maui

N

0 0.5 1 2 Mi

0 1 2 4 Km

Boundary Source: PBR Hawaii
Base Data Source: State of Hawaii GIS

SWCA ENVIRONMENTAL CONSULTANTS

Figure 8. This young M. blackburni caterpillar was photographed by Dr. David Preston (Bishop Museum) feeding on a non-native tree tobacco leaf (Nicotiana glauca) on March 13, 2008 in the southeastern portion of the Property.

On November 11, 2008, two large Blackburn's sphinx moth caterpillars were observed on the stems of tree tobacco plants within the Property by Dr. Preston and Ms. Gagne. The larger of the two caterpillars, approximately 100 mm (4 in) in length, was found about 30 m (100 ft) inside the Property from the Diamond Resort gate. The smaller caterpillar, approximately 50 mm (2 in) in length, was seen near the southern boundary of the Property (Figure 11).

Other non-native host plants of the Blackburn's sphinx moth caterpillars include *Solanum melongena* (eggplant), *Lycopersicon esculentum* (tomato), and possibly *Datura stramonium* (Jimson weed). These species have not been found within the Honua'ula Property in any previous study (Char 1988, 1993, 2004; SWCA 2009). However, adult moths are known to feed on nectar of the native *koali awahia* (*Ipomea indica*), and *halapepe* (*Pleomele auwahiensis*) plants, and possibly upon the native *maiapilo* (*Capparis sandwichiana*) and *'ilie'e* (*Plumbago zeylanica*) (USFWS 2005). The native *koali awahia*, *maiapilo*, and *'ilie'e* are widespread throughout the Honua'ula Property (SWCA 2009).

4.1.2 Hawaiian Hoary Bat (*Lasiurus cinereus semotus*)

SWCA biologists Ong and Mosher sighted a single endangered Hawaiian hoary bat at the southern boundary of the Property flying seaward at 18:44 hours on September 19, 2008. A single call from this individual was simultaneously recorded on the Anabat detector. No other sightings of bats were made during the period of study. The location of the bat sighting is illustrated on Figure 10. *Kiawe* which is abundant on the Property has been documented as roost trees for the Hawaiian hoary bat, thus, while it was not observed, it is possible that Hawaiian hoary bats roost within the Property.

4.2 Endemic Birds

No Hawaiian short-eared owls or *pueo* (*Asio flammeus sandwichensis*) were recorded during the wildlife surveys by Bruner (1988, 1993, and 2004). However, pueo were observed within the Property during the line transect surveys (Figure 4 and Figure 10). Neither the *pueo* nor barn

owls were observed during the bird point counts. Twelve (12) barn owls, six *pueo*, and six other unidentified owls were sighted in grassland habitat. The ratio of barn owl sightings to *pueo* sightings in grassland was estimated at 2:1. No pueo or barn owls were sighted in the southern remnant *kiawe-wiliwili* shrubland portion of the Property. No owl nests were found. Based on these surveys, the estimated density of owls in the grassland was 13.3 ± 3.7 SE individuals per km^2 (or 34.5 ± 9.1 individuals/$mile^2$). The estimated number of owls property-wide was 26.0 ± 0.3 SE (95% confidence interval: 14 - 46 owls). This results in an estimate of eight individual pueo (95% confidence interval: 5 – 15 individuals) present on the Property. These individuals are likely to occur within the *kiawe*-buffelgrass grassland habitat. The grasslands present at the Honua'ula Property are likely to provide good foraging, and nesting habitat for *pueo*. However, these nesting habits increase the species vulnerability to predation by rats (*Rattus* spp.), cats (*Felis catus*), and the small Indian mongoose (*Herpestes auropunctatus*), all of which are present in the area.

4.3 Indigenous Birds

No confirmed sighting of native birds occurred within the Property during the point count or transects surveys. No native birds had been recorded in or flying over the Property during the wildlife surveys by Bruner (1988, 1993, and 2004). Hawai'i DLNR-DOFAW biologist Betsy Gagné and SWCA biologist John Ford sighted a native black-crowned night heron (*Nycticorax nycticorax hoactli*) roosting in and flying among *kiawe* trees adjacent to a jeep road near an elevation of 150 m (500 ft) on the southern border of the Property. On the same day, the biologists also observed a flock of perhaps five to seven great frigatebirds or 'iwa (*Fregata minor palmerstoni*) hovering above and swooping down to feed or drink in one of the golf course ponds at the Wailea Resort, immediately west of the Honua'ula Property boundary. This suggestive that the Honua'ula golf course, once completed, will also serve to attract additional bird species.

Seabirds forage over the ocean, but many species return to nest inland. Seabirds that may be seen over the Property during the day include the great frigatebird or 'iwa (*Fregata minor palmerstoni*) and tropic birds (*Phaethon* spp.). The USFWS suggested that seabirds may fly over the Property at night to and from nesting sites at higher elevations on the slopes of Haleakalā. These seabirds include the endangered Hawaiian petrel (*Pterodroma sandwichensis*) and threatened Newell's shearwater (*Puffinus auricularis newelli*). While seabirds may traverse the area at night, they do not nest on the Property. Neither of the latter two species was observed during any of the wildlife surveys cited herein.

4.4 Migratory Birds

SWCA biologists have seen Pacific golden plovers (*Pluvialis dominica*) on golf cart roads and greens on adjacent golf courses on several occasions during winter months in past years. Dr. Phil Bruner also recorded one Pacific golden plover within the Property during his February 1988 survey. Some migratory birds overwinter in Hawai'i, most appearing in late August or September and leaving in May (Hawaiian Audubon Society 2005).

In a chance sighting in March 2006, SWCA biologist John Ford, M.S. observed a Northern harrier (*Circus cyaneus*) flying east to west, then back again and low over *wiliwili* trees in the southern portion of the Honua'ula Property near an elevation of 150 m (500 ft). Sightings of this relatively recent arrival to the islands have also been reported by others near Hosmer's Grove and over the Paliku end of the Haleakalā Crater floor and the surrounding hills, on the Island of Hawai'i over the Saddle Road, and on Kawailoa Ridge above Hale'iwa, O'ahu. That no other migratory birds were observed during this study could be a result of surveying at the start of the migration season.

4.5 Alien or Introduced Birds

In his most recent survey of the Property, Bruner (2004) found Japanese white-eye (*Zosterops japonicus*), house finch (*Carpodacus mexicanus*), black francolin (*Francolinus francolinus*), and zebra dove (*Geopelia striata*) to be the most abundant non-native birds at Honua'ula, followed by the nutmeg manikin (*Lonchura punctulata*), northern cardinal (*Cardinalis cardinalis*). He reported

no substantive change in the composition or abundance of alien bird species he described from the Property over a span of 16 years (Bruner 1988, 1993, and 2004).

SWCA biologists observed 16 species of introduced birds within the Property during this study. Japanese white-eye (*Zosterops japonicus*), nutmeg manikin (*Lonchura punctulata*), zebra dove (*Geopelia striata*), and northern cardinal (*Cardinalis cardinalis*) were found to be the most abundant (Table 1). African silverbills (*Lonchura cantans*) and red-crested cardinals (*Paroaria coronata*) were common along the southern border of the Property. Four additional introduced birds not reported by Bruner (1988, 1993, and 2004) were recorded during this study. Cattle egrets (*Bubulcus ibis*) were seen flying overhead on several occasions. Mourning doves (*Zenaida macroura*) were only heard in the 'a'ā section of the Property. Chestnut munias (*Lonchura atricapilla*) were seen on one occasion and Erckel's francolin (*Francolinus erckelli*) were heard once.

Table 1. Bird species and relative abundance observed on the Honua'ula Property during bird surveys in May and September 2008.

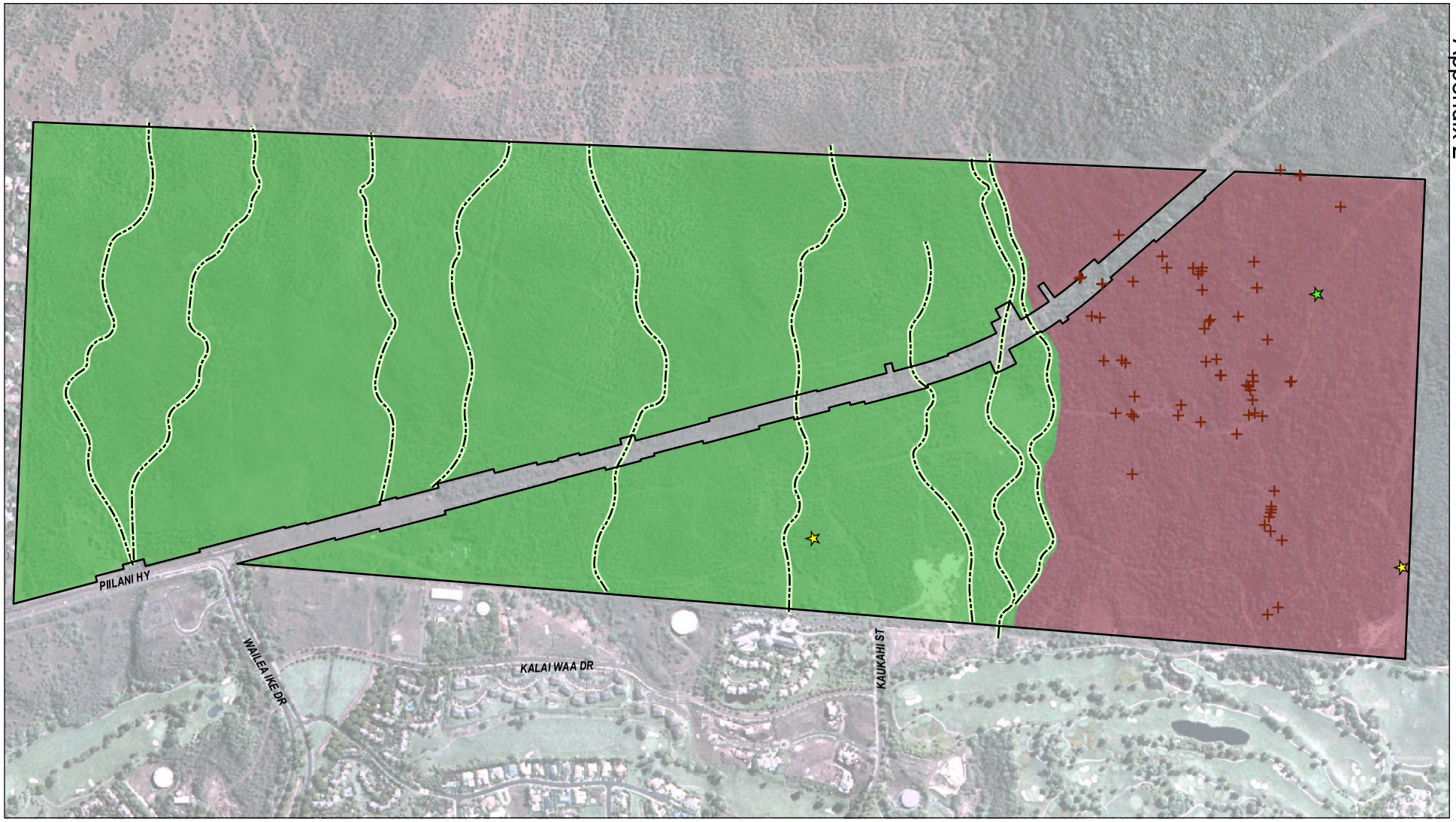
Species	Common Name	Status	Birds per point count (n=30)	Abundance Rank
Asio flammeus sandwichensis	Pueo	N (NR)	x	-
Bubulcus ibis	Cattle Egret	I (NR)	x	-
Zenaida macroura	Mourning Dove	I (NR)	0.03	12
Francolinus erckelli	Erckel's Francolin	I (NR)	0.03	12
Francolinus pondicerianus	Gray Francolin	I	0.23	9
Francolinus francolinus	Black Francolin	I	0.73	5
Streptopelia chinensis	Spotted Dove	I	0.30	7
Geopelia striata	Zebra Dove	I	1.70	3
Tyto alba	Barn owl	I	x	-
Zosterops japonicus	Japanese White eye	I	3.50	1
Mimus polyglottos	Common Mockingbird	I	0.03	12
Acridotheres tristis	Common Myna	I	0.07	11
Cardinalis cardinalis	Northern Cardinal	I	1.3	4
Carpodacus mexicanus	House Finch	I	0.23	9
Lonchura punctulata	Nutmeg Mannikin	I	3.03	2
Lonchura atricapilla	Chestnut Munia	I (NR)	x	-
Lonchura cantans	African Silverbill	I	0.67	6

I = introduced, N = native NR = new record since 2004
X= observed outside point counts

4.6 Mammals

The Hawaiian hoary bat (see 5.1.2) was the only native mammal observed on the Property. The small Indian mongoose (*Herpestes javanicus*) was observed within the Property, but was uncommon. Small herds of four to 12 axis deer (*Axis axis*) were commonly seen. Deer scat, tracks, and evidence of buck rubs (rubbing of antlers on trees) were evident throughout the entire parcel. Mongoose and deer were previously reported by Bruner (1988, 1993 and 2004). Goats (*Capra hircus*) have also been seen by others in the Property; however, none were observed during this study.

Domestic cattle (*Bos taurus*) are grazed infrequently within the northern portion of the Property and regularly to the east on lands owned by 'Ulupalakua Ranch; however, no cattle or evidence of cattle were observed within the boundaries of the Property during this study.



Appendix 2

Legend

- Project Boundary
- *Manduca blackburni* (Blackburn's Sphinx Moth) Caterpillar Sighting March 13, 2008
- *Manduca blackburni* (Blackburn's Sphinx Moth) Caterpillar Sighting Nov 11, 2008
- *Manduca blackburni* (Blackburn's Sphinx Moth) Sign Observed May 27-28, 2008

Vegetation Types

- Kiawe-buffel Grass Grassland
- Kiawe-wiliwili Shrubland
- Mixed Gully, Kiawe-Guinea Grass Vegetation

Figure 9
Locations of Blackburn Sphinx Moth Caterpillars and Sign Locations

0 250 500 1,000 ft

0 50 100 200 M

N

Boundary Source: PBR Hawaii
Aerial Source: Pacific Disaster Center (PDC)

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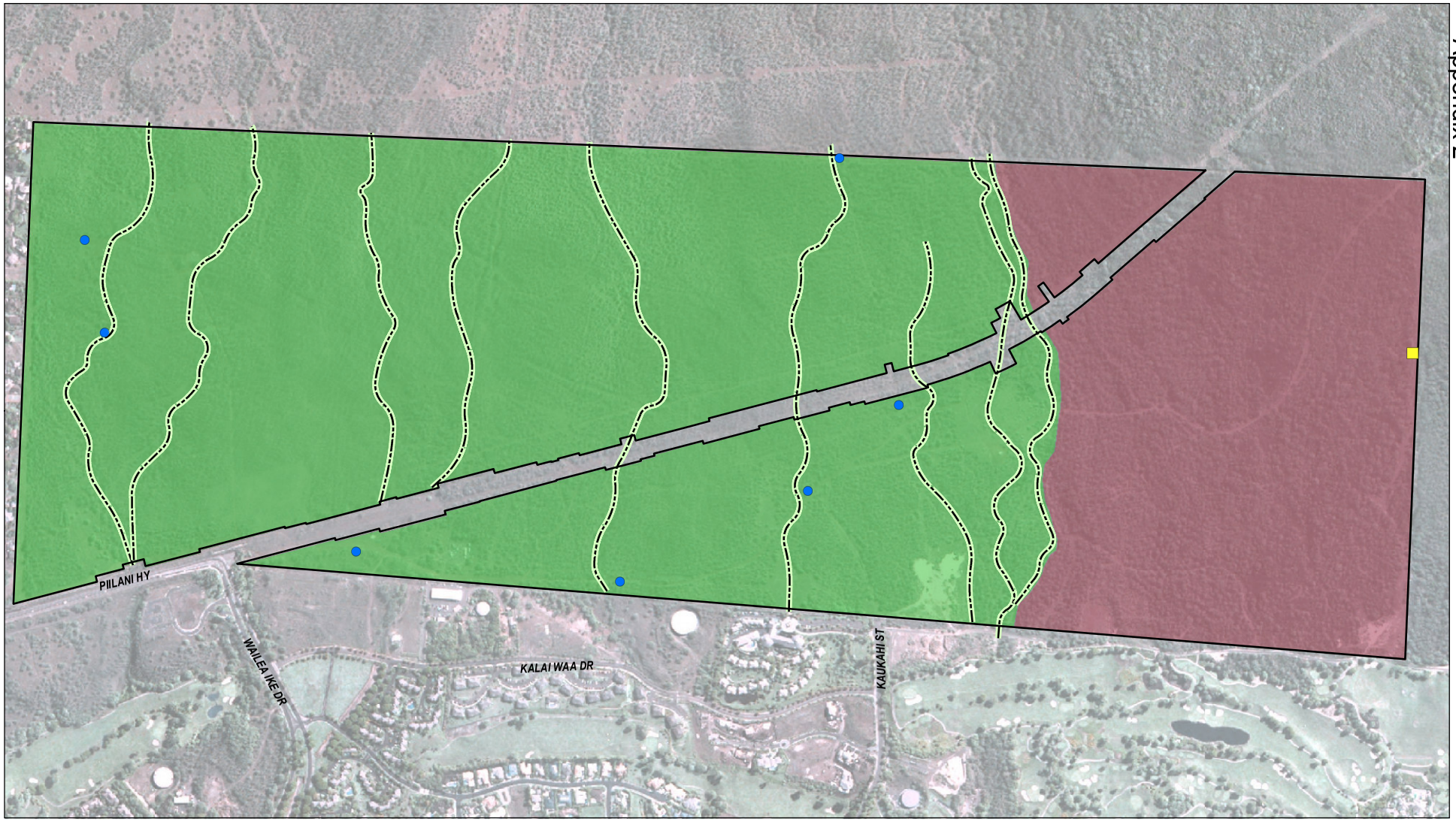

Legend

- Project Boundary
- *Asio flammeus sandwichensis* (Pueo) Sighting
- *Lasiurus cinereus semotus* (Hoary Bat) Sighting

Vegetation Types

- Kiawe-buffel Grass Grassland
- Kiawe-wiliwili Shrubland
- Mixed Gully, Kiawe-Guinea Grass Vegetation

Figure 10
Pueo and Bat Sightings

N

0 250 500 1,000 ft

0 50 100 200 M

Boundary Source: PBR Hawaii
Aerial Source: Pacific Disaster Center (PDC)

SWCA ENVIRONMENTAL CONSULTANTS

Following this study; however, cattle were allowed to graze within the northern *kiawe*-buffelgrass lands within the Property. Cats (*Felis catus*), rats (*Rattus* spp.) and mice (*Mus*), while not observed, are expected to be present within the Property due to its proximity to the Maui Meadows subdivision and the Wailea Resort. Rat and mouse remains were detected in owl pellets found on the Property.

4.7 Reptiles and Amphibians

There are no native reptiles or amphibians in Hawai'i (McKeown 1996). Geckos (Gekkonidae) were heard calling, but not seen during avian point counts. Geckos were also heard but not seen along jeep roads on the southern border of the Property. No skinks (Scincidae) were observed during avian point counts. No amphibians were seen within the Property.

5.0 DISCUSSION

Two endangered animal species and one species of concern have been documented by SWCA biologists on the Property: the endangered Blackburn's sphinx moth (*Manduca blackburni*), the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), and the pueo (*Asio flammeus sandwichensis*), respectively.

Of particular interest is the surprising number of endangered Blackburn sphinx moth (*Manduca blackburni)* sightings (caterpillars and sign) within the Property. All sightings were associated with non-native tree tobacco plants (*Nicotiana glauca*). These are aggressive weedy plants that grow opportunistically in open, arid, disturbed locations (Wagner et al 1999) and are commonly found along road grades in the northern portion of the Property and throughout the *kiawe-wiliwili* shrubland. The USFWS's Recovery Plan for this species (USFWS 2005) identified conservation and recovery activities, including protection, management, and restoration of habitat and the species' host plants, specifically the native *'aiea* (*Nothocestrum* spp.), and a captive breeding and translocation program. While *'aiea* is not found within the Property and is not known to thrive at low elevations in areas like Honua'ula, the non-native tree tobacco is common here and is apparently frequented by the moths. The removal of non-native tobacco plants during construction will likely result in the loss of non-native feeding habitat for the caterpillar. The potential loss of food plants for the adult moths also exists as some other native plants are removed in portions of the Property.

Three recovery units encompassing 13 management units were identified in the Blackburn Sphinx Moth Recovery Plan (USFWS 2005) as necessary for the long-term survival and recovery of the species. The Pu'u O Kali Management Unit (Unit 8) and the Ahihi-Kinau NAR – Ulupalakua – Auwahi – Kanaio Management Unit (Unit 9) in South Central Maui are closest to Honua'ula (Figure 8). Designated critical habitat is found within Units 8 and 9, and within Kanaha Pond – Spreckelsville Management Unit (Unit 7) located near the Kahului Airport on Maui's north central coastline.

The pueo is most likely to be affected during the construction phase of the project on the site. Construction through grassland habitat will potentially disturb roosting and nesting pueo and is likely to permanently displace pueo from the Property due to the loss of grassland habitat.

No evidence of roosting or foraging by endangered Hawaiian hoary bats was observed by Bruner (1988, 1993, 2004) or SWCA (2009). Definitive conclusions about habitat use cannot be made on existing evidence. The removal of *kiawe* trees during construction may result in the loss of roosting habitat; however, many large stature trees suitable for roosting will be preserved and others propagated for landscaping as the site is developed.

Upon construction of the residential community and golf course at Honua'ula, water features and open fairways associated with the golf course will attract a number of endangered species to the Property. These include the *koloa* (*Anas wyvilliana*), *ae'o* (*Himantopus mexicanus knudseni*), 'alae ke'oke'o (*Fulica alai*), *'alae 'ula* (*Gallinula chloropus sandvicensis*), and *nēnē* (*Branta sandvicensis*).

In addition, there is the potential for lighting present on the Property to present an attraction hazard to juveniles of the threatened Newell's shearwater (*Puffinus auricularis newelli*) and endangered Hawaiian petrel (*Pterodroma sandwichensis*).

The native migratory *kolea* (*Pluvialis fulva*) which are protected under the Migratory Bird Species Act, frequently uses roads and open spaces when over-wintering in Hawai'i and may be displaced if construction occurs during the migratory season. However, it is anticipated that the construction of open spaces, gardens and lawns on the Property will provide additional habitat that kolea can utilize.

6.0 PROPOSED MITIGATION MEASURES

The Maui County Council promulgated 28 specific conditions in granting a Phase I project district zoning approval. Their specific conditions related to wildlife within the Property include:

> *7. That Honua'ula Partners, LLC, its successors and permitted assigns, shall prepare an animal management plan that shall be submitted during Project District Phase II processing and approved by the Department of Land and Natural Resources prior to submittal of Project District Phase III processing. Said plan shall include procedures for the management of animal intrusions including, but not limited to, construction of boundary or perimeter fencing, wildlife control permits, and rodent and feral cat control.*
>
> *Honua'ula Partners, LLC, its successors and permitted assigns, shall implement the approved animal management plan. The Department of Land and Natural Resources may require periodic updates of the plan.*
>
> *9. That Honua'ula Partners, LLC, its successors and permitted assigns, shall prepare an assessment of the owl (Pueo or Hawaiian Short-eared Owl) and the Hawaiian Hoary Bat in coordination with the Department of Land and Natural Resources, and, if appropriate, mitigative measures shall be incorporated into Kīhei-Makena Project District 9. Said assessment shall be prepared prior to submittal of Project District Phase II processing.*

Honua'ula Partners, LLC is proposing to implement the following measures to conserve elements of the remnant *kiawe-wiliwili* shrubland and to protect the native plants and animals within the Property.

- To help provide habitat for Blackburn sphinx moths (*Manduca blackburni*), a Native Plant Preservation Area encompassing a contiguous area within the remnant *kiawe-wiliwili* shrubland will be dedicated in perpetuity to protect as much of the remnant *kiawe-wiliwili* shrubland plant community as possible. The protected area will meet the 7.3-52.6 ha (18-130 ac) directive imposed by the Maui County Council, and will ultimately be subject to approval by the Council. The Native Plant Preservation Area will encompass the highest densities of the rarest elements of the native vegetation within the project parcel. The only non-native species that will be allowed to remain in this area will be the tree tobacco (*Nicotiana glauca*) so as to provide food and habitat for endangered Blackburn's sphinx moths (*Manduca blackburni*). This may enhance the geographic connectivity between the two recovery units; and may also provide a source of sphinx moth caterpillars for the translocation program which has been identified as a desirable recovery activity (USFWS 2005).

- Conversely, non-native tree tobacco (*Nicotiana glauca*) plants will be removed from the property outside the Native Plant Preservation Area prior to construction. This will be done in consultation with biologists from DLNR-DOFAW and the USFWS to prevent accidental take of the Blackburn's sphinx moth (*Manduca blackburni*) caterpillar.

- Construction operations will be closely monitored to prevent accidental take of the various Blackburn's sphinx moth (*Manduca blackburni*) life stages. Should sphinx moths be found,

host plants will be marked for protection and not removed until deemed appropriate by DLNR-DOFAW and USFWS biologists.

- Upon completion of the proposed project, restrictions on landscaping and gardening will be enacted to prevent propagation of any plant in the Solanaceae (Nightshade) family that may attract Blackburn's sphinx moths (*Manduca blackburni*).

- A translocation program for Blackburn's sphinx moth (*Manduca blackburni*) caterpillars will be developed and implemented through preparation of a Habitat Conservation Plan (HCP), particularly for caterpillars found in landscaped areas of the Property, in consultation with DLNR-DOFAW and the USFWS.

- Intensive wildlife surveys will be continued from November – May through construction of the proposed project to look for signs of endangered Blackburn sphinx moths (*Manduca blackburni*) within the Property, to distinguish any signs found as the Blackburn sphinx moth (*Manduca blackburni*) and not other more common horn worm species, and to protect individual moths from destruction.

- Additional Hawaiian hoary bat (*Lasiurus cinereus semotus*) point count surveys will be conducted prior to construction to document the changes in abundance and determine habitat utilization of these species during the wet and dry seasons.

- A qualified wildlife biologist will monitor the Property for bats (*Lasiurus cinereus semotus*) during construction. Should bats (*Lasiurus cinereus semotus*) be found at the site during construction, assistance will be requested from the USFWS office in Honolulu.

- Clearing of habitat during construction will be monitored to reduce the potential take of non-volent juvenile bats (*Lasiurus cinereus semotus*) (Hart 2003).

- Propagation of native tree species will be conducted during landscaping to provide suitable bat (*Lasiurus cinereus semotus*) roosting habitat to mitigate for the loss of possible roosting trees during construction.

- Potential impacts to seabirds will be minimized by shielding outdoor lights in compliance with Chapter 20.35 (Outdoor Lighting) of the Maui County Code, avoiding night-time construction, and providing all project staff with information regarding seabird fallout. All project lights will be shielded so the bulb can only be seen from below. This is a common and successful mitigation measure employed throughout the Hawaiian Islands.

- Construction around areas found with pueo (*Asio flammeus sandwichensis*) nests will be delayed until the chicks have fledged.

- The entire perimeter of the Property has already been fenced to discourage feral ungulates and grazing cattle from entering the remnant *kiawe-wiliwili* shrubland; however, the fence is porous. Fencing requirements will be reviewed and updated as establishment of the Native Plant Preservation Area construction begins. An animal management plan will be implemented by the Natural Resource Manager to insure that goats, deer, pigs, and stray cattle are removed in a human manner from the proposed for native plant protection on the Property

- A Natural Resource Manager will be employed by Honua'ula Partners, LLC to develop and implement specific conservation programs to help insure the protection of native plants and animals within the Native Plant Preservation Area and other areas designated for native plant protection on the Property.

- An Animal Management Plan is being prepared under separate cover in cooperation with DLNR-DOFAW and USFWS during Project District Phase II processing.

- A Conservation and Stewardship Plan is also being prepared under separate cover to implement a natural resource management plan for the Native Plant Preservation Area and other areas designated for native plant protection on the Property.

- Finally, a multi-species Habitat Conservation Plan (HCP), to include the candidate endangered *'āwikiwiki* (*Canavalia pubescens*) is being prepared under Section 10(a)(1)(B) of the Endangered Species Act and in collaboration with DLNR and USFWS.

Taken together with the mitigation measures identified in the Botanical Survey of Honua'ula (Wailea 670) (SWCA 2009), these actions fully satisfy the objectives and the intent of the special Project District Phase II conditions promulgated by the Maui County Council.

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Appendix 3

Terrestrial Flora and Fauna Survey

Proposed Honua'ula (Wailea 670) Water System Kīhei, Maui, Hawai'i

Prepared for

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December 2010

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1.0 INTRODUCTION

In August 2010, SWCA Environmental Consultants (SWCA) was tasked by Honua'ula Partners, LLC to conduct a terrestrial flora and fauna survey for a proposed conveyance system to provide both potable and non-potable water for the proposed Honua'ula project. The survey was conducted in support of an Environmental Impact Statement (EIS) being prepared by PBR Hawaii & Associates, Inc. (PBR Hawaii), in compliance with Chapter 343 Hawaii Revised Statutes (HRS) and Habitat Conservation Plan (HCP) being prepared by SWCA under Section 10 of the Endangered Species Act (ESA) for the proposed Honua'ula project.

Honua'ula is a master-planned, mixed-residential community encompassing a rectangular area of 271 hectares (ha) or 670 acres (ac) east of, and adjacent to, the existing Wailea Resort in Kīhei, Maui (Figure 1). It is bounded by the Maui Meadows subdivision to the north, the Makena Golf Course to the south, the Wailea Golf Course to the west, and the 'Ulupalakua Ranch to the east.

The offsite components of the proposed private water system consist of: 1) brackish water wells within the subject well field; 2) one potable water storage tank and one non-potable water tank located mauka of the project area; and 3) waterlines to convey brackish water from the wells to the project area and the mauka tanks and then back to the project area. Water treatment and storage facilities and waterlines for the proposed water system also occur within the Honua'ula project area (PBR Hawaii 2010).

This report summarizes the findings of a terrestrial flora and fauna survey conducted by SWCA biologists Ling Ong, Ph.D., Shahin Ansari, Ph.D., Jaap Eijzenga, M.S., Tiffany Thair, M.S. candidate, and Ryan Taira, B.A. between August 30 and September 1, 2010 and on November 23, 2010. The survey area is shown in Figure 2. The objectives of the survey were:

1. To identify and document the presence and relative abundance of all plant species which occur within the survey area;
2. To provide a general description of the vegetation in the survey area;
3. To identify and document the presence and relative abundance (as appropriate) of bird, mammal, amphibian, reptile, and invertebrate macrofauna which occur within the survey area;
4. Identify and map any State- or Federally listed candidate, threatened, or endangered species, species of concern and/or rare (either locally or State-wide) species found or known to occur at the survey area.

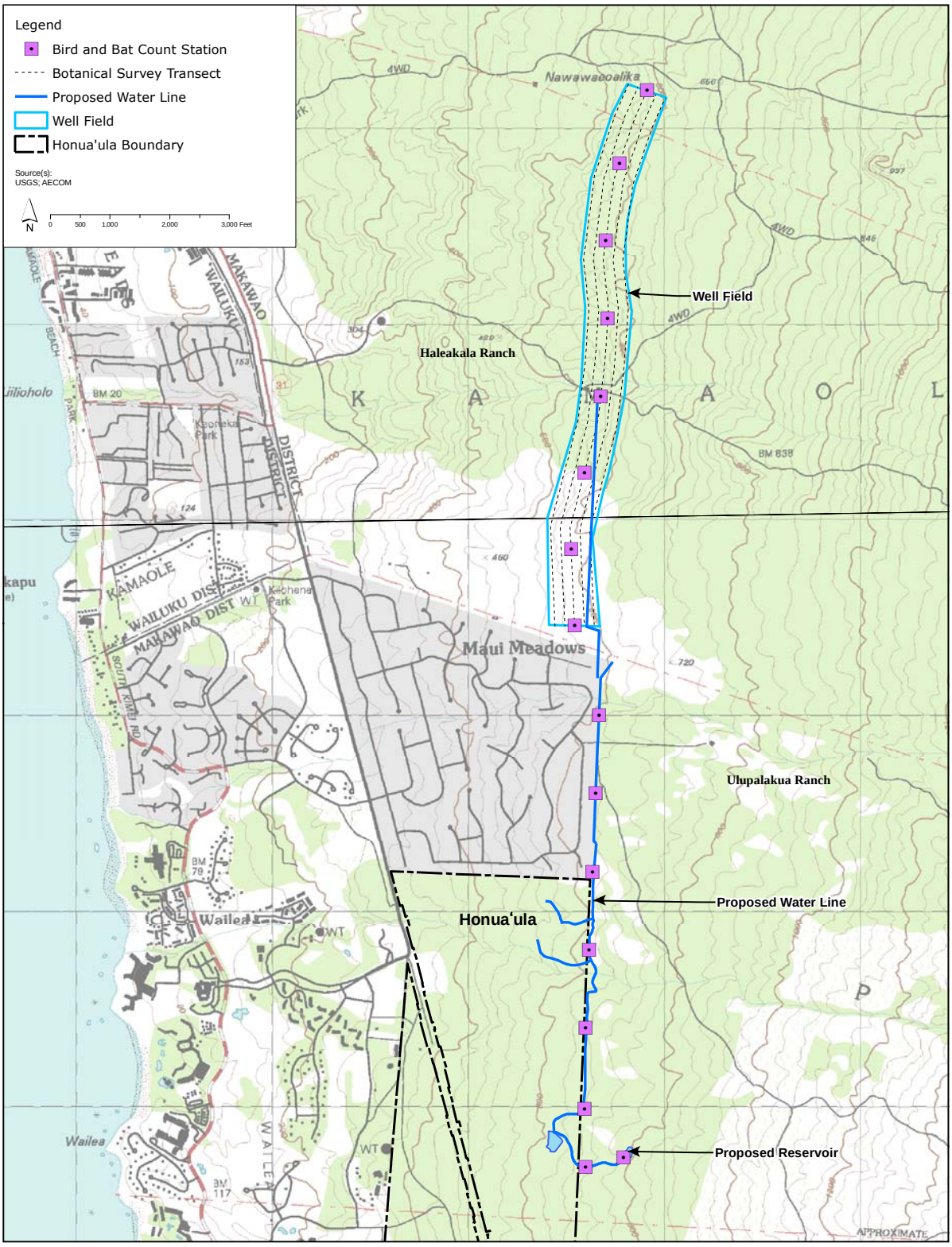
2.0 DESCRIPTION OF THE SURVEY AREA

The survey area is located on the lower slopes of Haleakalā in the Kīhei-Mākena region on the leeward side of East Maui (Figure 1). The climate in the region is generally dry with an average annual rainfall ranging from 178 to 761 mm (7.01-29.97 inches) and an annual average temperature of about 76°F (County of Maui 2008). The survey area can be divided into two distinct areas: 1) the well field; and 2) the water distribution line/tanks (Figure 2).

The well field is a rectangular area located on agricultural land owned by Haleakalā Ranch immediately north of the Maui Meadows subdivision and 4 km (2.5 mi) to the north of Honua'ula. The area is designated for well development for Honua'ula. The general topography of the well field is characterized as relatively flat to gently sloping westerly toward the ocean. Soils are primarily characterized as Keawakapu Extremely Stony Silty Clay Loam, 3 to 25% slopes, with a small area of Very Stony Land in the north (Foote et al. 1972). The substrate of the well field is primarily rocky. Several small drainage gulches, characterized by patches of exposed bedrock, transverse portions of the field; however, these intermittent gulches likely only carry water for a short time following intense rainfall events. Most of the field is underlain by 'a'ā and pāhoehoe lava flows ranging from 140,000 to 950,000 years old. A younger flow, between 13,000 and 30,000 years old, crosses the northern portion of the field (Sherrod et al. 2007). The younger flows have not undergone as extensive weathering and are characterized by a rough surface composed of broken 'a'ā lava. Numerous jeep roads cross over the area.

Figure 1. Vicinity Map.

Figure 2. Honua'ula Water System Survey Area.



The proposed water distribution line is located along the eastern (mauka) boundary of the Maui Meadows subdivision and proposed Honua'ula project and adjacent areas within lands owned by 'Ulupalakua Ranch. A 9 m (30 ft) wide easement exists for the distribution line. It is anticipated that all construction related impacts would be confined to the easement; thus, our survey area for the distribution line is roughly 9 m wide. Two proposed offsite water storage tanks are located mauka of the distribution line at approximately 247 m (810 ft) elevation (PBR Hawaii 2010; Wilson Okamoto Corporation 2010). SWCA surveyed an area of approximately 0.25 ha (0.61 ac) for the tanks. SWCA also surveyed a 7 m (24 ft) wide and 229 m (750 ft) long area connecting the waterline from the Honua'ula property line to the offsite tanks.

This portion of the survey area is primarily flat, but slopes seaward near the proposed water tanks and slightly slopes seaward toward the adjacent residences. Soils are defined entirely as Keawakapu Extremely Stony Silty Clay Loam, 3 to 25% slopes (Foote et al. 1972). The majority of this area is underlain by 'a'ā and pāhoehoe lava flows ranging from 140,000 to 950,000 years old. A portion is underlain by a younger 'a'ā flow between 55,000 and 140,000 years old (Sherrod et al. 2007). The landscape and vegetation in the area has been historically influenced by military training activities (WWII), invasion by non-native plants species, cattle grazing, grazing by feral ungulates, residential development, and fires (SWCA 2010a).

Several components of the water system occur within the proposed Honua'ula project area including one potable water tank, one non-potable water tank, a reverse osmosis plant, two brackish water wells, and portions of the distribution line. The flora and fauna of the Honua'ula property were already surveyed by SWCA in 2008 (SWCA 2010a, 2010b).

3.0 PREVIOUS STUDIES

Various flora and fauna surveys have been conducted within the nearby Honua'ula property (Char and Linney 1988; Char 1993, 2004; Bruner 1988, 1993 and 2004; and SWCA 2006, 2009a, 2009b, 2010a and 2010b; Altenberg 2007); however, none have been conducted specifically within the areas where the offsite components of the water system are proposed.

As mentioned above, some of the components of the water system fall within the boundaries of the Honua'ula property. Three distinct vegetation types are found within Honua'ula: kiawe-buffelgrass (*Prosopis pallida-Cenchrus ciliaris*) grassland, gulch vegetation, and mixed kiawe-wiliwili (*Prosopis pallida-Erythrina sandwicensis*) shrubland (SWCA 2010a). All of the proposed onsite components of the water system occur within the kiawe-buffelgrass grassland of the Honua'ula property. During SWCA's botanical survey of the project area in March and May 2008, no native plant species were identified within the footprint of the water system components within the Honua'ula property.

No Blackburn's sphinx moths (*Manduca blackburni*), caterpillars or signs were observed within the footprint of the water system components on the Honua'ula property by SWCA (2010b) or Bruner (1988, 1993 and 2004). SWCA biologists observed a single endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) flying seaward over the property at the southern boundary (SWCA 2010b). Sixteen species of introduced birds and one native bird, the pueo (*Asio flammeus sandwichensis*), have also been seen at Honua'ula (SWCA 2010b). Prior surveys of the same parcel by Bruner (1988, 1993 and 2004) documented similar non-native avian species. Bruner (1988, 1994 and 2004) did not find pueo or the endangered Hawaiian hoary bat.

4.0 SWCA SURVEY METHODS

4.1 Flora

SWCA biologists initially conducted a literature review of available scientific and technical literature regarding natural resources within the vicinity of the survey area. A pedestrian survey of the area was conducted on August 31, September 1, and November 23, 2010. A Trimble GeoXT mapping-grade GPS unit preloaded with the study transects was used to guide the survey and collect point data on rare native plants (Figure 2). The SWCA botanists walked transects at 50 m (164 ft) intervals. Each botanist thoroughly scanned roughly 25 m (82 ft) on both sides of each transect and documented all plant species observed. Due to the exceptionally dry conditions in the survey area, the biologists

conducted more intensive searches of gullies, overhangs, steep slopes, shaded sites, and other areas most likely to support vegetation.

All plant species observed within the survey area were documented and notes were made on their abundance and distribution, community structure, and disturbances. Plants were identified in the field wherever possible. Plants which could not be positively identified were collected for later determination in the herbarium and for comparison with the most recent taxonomic literature.

Plants recorded during the survey are indicative of the season and environmental conditions at the time of the survey. This survey was conducted during an extensive drought period, which can mask the presence or identification of plant species known to occur in similar habitats within the region. It is possible that additional surveys conducted at a different time of the year, or after a significant rain event, would result in variations in the species and abundances of plants observed due to species present in the seed bank or dispersal from adjacent areas.

4.2 Fauna

SWCA wildlife biologists conducted avian point count surveys on August 31, September 1, and November 23, 2010. Sixteen point count stations were placed within the study area (Figure 2). The location of the observer at each point count site was established in the field with a hand-held GPS receiver. Field observations of birds were recorded using 10 x 50 binoculars with a 6.5 degree field of vision. The observer also listened for avian vocalizations. The relative densities of species were estimated using eight-minute 100 m (328 ft) radius point counts (Lynch 1995) during peak bird activity periods (0600–1100, 1600–1900) to maximize the likelihood of detecting birds during the survey. Birds observed between count stations were also noted. Mammals, reptiles, amphibians, insects, and other invertebrates seen or heard during the point count surveys or between count stations were also documented.

SWCA biologists conducted evening surveys for the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*). Surveys were conducted on the evenings of August 30 and 31, and November 23, 2010 (between 1800 and 0000). The same point count stations for the avian fauna survey were used and each count station was sampled for eight minutes. These surveys were conducted under ideal weather conditions using night vision goggles (Morovison PVS-7 Ultra) during count stations surveyed after twilight. The detection distance for bats using night vision goggles was estimated to be 30 m (98 ft) radius at each point count station.

Surveys for the endangered Blackburn's sphinx moth (*Manduca blackburni*) were conducted by inspecting non-native tree tobacco plants (*Nicotiana glauca*) encountered in the survey area. This species is a host plant used by the various life stages of Blackburn's sphinx moths. Leaves and stems were examined carefully for the presence or sign of moths, including frass (fecal matter), cut stems and leaves, and eggs. Normally, caterpillars and sign are expected to be more abundant in November to December following periods of heavy rainfall (USFWS 2005).

5.0 FINDINGS

5.1 Flora

Thirty (30) plant species were recorded within the survey area, none of which are listed as threatened, endangered, or candidate endangered species or rare native Hawaiian plant species by the Federal or State governments. Six of these species (or 20% of the total species) are native to the Hawaiian Islands: wiliwili (*Erythrina sandwicensis*), 'uhaloa (*Waltheria indica*), pili grass (*Heteropogon contortus*), 'iwa'iwa (*Doryopteris decipiens*), pua kala (*Argemone glauca*), and 'ilie'e (*Plumbago zeylanica*). Of these, only wiliwili, 'iwa'iwa, and pua kala are endemic, or found only in the Hawaiian Islands (Wagner et al. 1999; Palmer 2003). A list of all plant species observed by SWCA biologists within the survey area is included in Appendix 1 of this report.

The vegetation in the well field portion of the survey area is characterized as kiawe-buffelgrass (*Prosopis pallida-Cenchrus ciliaris*) grassland. The kiawe trees range from 4.5 to 8 m (15-26 ft) tall with sparse buffelgrass cover in the understory due to dry conditions and grazing by ungulates (Figure

3). Guinea grass (*Urochloa maxima*) and tree tobacco (*Nicotiana glauca*) are scattered throughout the field, and 'uhaloa is present on some of the rocky outcrops. A small wiliwili grove, consisting of six trees, occurs in the northeastern portion of the well field. As mentioned in Section 4 above, most of the vegetation in the well field was extremely dry or dead during the survey due to prolonged drought conditions in southeast Maui. Extensive grazing has also disturbed the vegetation in the area.

The waterline/tanks portion of the survey area supports vegetation similar to that found in the well field. Kiawe trees are abundant in the canopy and buffelgrass is sparsely present in the understory (Figure 4). Several ornamental species are growing over the fence line from the adjacent subdivision such as *Plumbago auriculata* and coconut (*Cocos nucifera*). Other non-native weedy trees isolated throughout the distribution line area include koa haole (*Leucaena leucocephala*), African tulip tree (*Spathodea campanulata*), and chinaberry (*Melia azedarach*).

5.2 Fauna

No State- or Federally listed threatened, endangered, or candidate bird, mammal, or insect species were observed during our survey. None of the fauna recorded by SWCA biologists during the survey are native to the Hawaiian Islands. Fifteen introduced bird species and a single migratory visiting bird species were recorded during the survey. Zebra doves (*Geopelia striata*) were notably the most abundant during the survey. Grey francolin (*Francolinus pondicerianus*), common myna (*Acridotheres tristis*), Japanese white-eye (*Zosterops japonicus*), and African silverbill (*Lonchura cantans*) were also common. All of these species are common to the main Hawaiian Islands, particularly in urban or disturbed areas (HAS 2005). The migratory Pacific golden-plover (*Pluvialis fulva*) or kolea was also heard during the survey. Several additional non-naturalized birds were also heard near the Maui Meadows subdivision including blue macaw (*Cyanopsitta spixii*), African grey parrot (*Psittacus erithacus*), and salmon-crested cockatoo (*Cacatua moluccensis*). The relative abundance of observed bird species is shown in Table 1.

The avian diversity and abundance in the survey area is low, possibly due to the prolonged drought in the area. Based on observations at similar habitats at the nearby Honua'ula project area under normal rainfall conditions, other birds that may occur in the area include Erckel's francolin (*Francolinus erckelli*), nutmeg manikin (*Lonchura punctulata*), and chestnut munia (*Lonchura atricapilla*). The native Hawaiian short-eared owl (*Asio flammeus sandwichensis*) and the introduced barn owl (*Tyto alba*) may also be expected to be in the area based upon previous surveys of adjacent lands (SWCA 2010b).

The endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) was not seen during the three evenings. The only living mammals observed during the survey were mice (*Mus domesticus*), dogs (*Canis lupus familiaris*), mongoose (*Herpestes javanicus*), and axis deer (*Axis axis*). Skeletal remains of six cows (*Bos taurus*), and several deer were seen in the well field. Deer and cow droppings were reported from both areas. Although not observed, it is likely that non-native rats (*Rattus* spp.), and feral cats (*Felis catus*) also occur in the area.

There are no native reptiles or amphibians in Hawai'i (McKeown 1996). During the survey, geckos (Family: Gekkonidae) were heard, but not seen.

Neither adult nor larval endangered Blackburn sphinx moths (*Manduca blackburni*) were observed by SWCA biologists during the survey. Despite the presence of the tree tobacco (*Nicotiana glauca*), a non-native larval host plant, no sign of the Blackburn sphinx moth (e.g., cut stems and leaves, frass and eggs) was observed. Other insects and invertebrates observed in the survey area include the carpenter bee (*Xylocopa sonorina*), moths (Order: Lepidoptera), including a large number of koa haole moths (*Macaria abydata*) and dragonflies (Order: Odonata).

Figure 3. View of the drought stricken kiawe-buffelgrass (*Prosopis pallida-Cenchrus ciliaris*) grassland in the well field portion of the survey area.

Figure 4. View of kiawe trees (*Prosopis pallida*) and sparse buffelgrass (*Cenchrus ciliaris*) cover near the Maui Meadows subdivision along the proposed distribution line.

Table 1. Relative abundance of birds observed during point counts.

Species Name	Common Name(s)	Status	Birds per point count (n=16)	Abundance Rank
ARDEIDAE				
Bulbulcus ibis	Cattle egret	X	0.06	10
PHASIANIDAE				
Francolinus francolinus	Black francolin	X	0.06	10
Francolinus pondicerianus	Grey francolin	X	1.94	2
CHARADRIIDAE				
Pluvialis fulva	Pacific golden-plover	V	*	*
COLUMBIDAE				
Geopelia striata	Zebra dove	X	4.63	1
Streptopelia chinensis	Spotted dove	X	0.87	6
Zenaida macroura	Mourning dove	X	0.063	10
ZOSTEROPIDAE				
Zosterops japonicus	Japanese white-eye	X	1.19	4
MIMIDAE				
Mimus polyglottos	Northern mockingbird	X	0.13	9
STURNIDAE				
Acridotheres tristis	Common myna	X	1.56	3
EMBERIZIDAE				
Cardiinalis cardinalis	Northern cardinal	X	0.50	7
Paroaria coronata	Red-crested cardinal	X	0.13	9
FRINGILLIDAE				
Carpodacus mexicanus	House finch	X	0.50	7
PASSERIDAE				
Padda oryzivora	Java sparrow	X	0.13	9
Passer domesticus	House sparrow	X	0.31	8
Lonchura cantans	African silverbill	X	0.94	5
Unknown			1.50	

* = observed outside of point count stations.
X = non-native/introduced to the Hawaiian Islands.
V = visitor; seasonally present in the Hawaiian Islands.

6.0 CONCLUSIONS AND RECOMMENDATIONS

No Federal or State candidate, proposed or listed threatened or endangered species were observed or previously reported to be within the proposed well field, waterline, or tank areas. The majority of the species observed in the proposed water system area (80% of the flora and over 95% of the birds and mammals) are introduced to the Hawaiian Islands. Most of the native plants observed during the survey are commonly found throughout Maui and the main Hawaiian Islands. Of the native plants in the survey area, only wiliwili has a limited distribution throughout the Hawaiian Islands. It remains locally common in southeastern Maui. The only native bird species recorded during the survey - the

Pacific golden-plover - is abundant throughout Hawai'i and uses a variety of habitats including mudflats, lawns and rooftops (HAS 2005).

As stated above, this survey was conducted during an extensive drought period, which can possibly mask the presence or identification of plant species known to occur in similar habitats within the region. It is possible that additional surveys conducted at a different time of the year or after a significant rain event would result in variations in the species and abundances of plants observed due to species present in the seed bank or dispersal from adjacent areas. Patches of native plants [e.g., wiliwili (*Erythrina sandwicensis*) and maiapilo (*Capparis sandwichiana*)] do occur in the vicinity of the well field in the adjacent younger lava flows.

Based on findings of this survey and the results of prior flora and fauna surveys within the Honua'ula project area, no intact native ecosystems are expected to be impacted by the proposed well development and waterline transmission work associated with the Honua'ula development. Furthermore, given that the survey area has been highly altered by human activity and lacks any native species or habitats of special concern, the proposed work is not expected to result in any significant adverse impact on the flora or fauna in this part of Maui.

Wiliwili trees throughout Maui were damaged or destroyed during the statewide outbreak of the invasive gall wasp (*Quadrastichus erythrinae*). Protecting local surviving wiliwili tress will contribute to enhancing the island-wide population of this endemic species. It is recommended that during construction of the water system the wiliwili trees located in the northern portion of the well field and within the proposed waterline be avoided to the maximum extent possible.

If non-native tree tobacco plants need to be removed or disturbed while conducting the proposed work, the plants should first be surveyed by a qualified biologist for the presence of Blackburn's sphinx moth eggs, larvae, or "signs" indicating the possibility of pupating larvae (frass, chewed stems or other browsing characteristic of Blackburn's sphinx moth on tree tobacco plants). If the tree tobacco plant is entirely herbaceous (such as a small un-branched young plant), and there are no Blackburn's sphinx moth eggs, larvae, or signs indicating the possibility of pupating larvae, the plant may be removed by the roots. If Blackburn's sphinx moth eggs, larvae, or "signs" indicating the possibility of pupating larvae (such as frass, chewed stems or other browsing characteristic of Blackburn's sphinx moth on the plant) are observed, the USFWS recommends that the plant not be removed until the plants are free of Blackburn's sphinx moth eggs and larvae. Then the following steps should be taken to minimize potential impacts to Blackburn's sphinx moth individuals:

- If the plant is woody and there are no Blackburn's sphinx moth eggs, larvae, or signs indicating the possibility of pupating larvae (such as frass, chewed stems or other browsing characteristic of Blackburn's sphinx moth on the plant), the above-ground portion of the plant may be cut off and removed.

- If the plant has developed woody structure, it is possible that the signs of Blackburn's sphinx moth foraging have been shed and that root disturbance could dislodge larvae. Therefore, the soil and plant roots should be left undisturbed for a one-year period. A 10 m (33 ft) buffer should be established around the woody host plant to prevent disturbance to any pupating larvae which may be in the ground in the area around the plant. Cut stems should be maintained to be free of re-growth (by either carefully painting herbicide on the cut stem or frequent hand clipping) to prevent leaf growth and potential use by the moth. After one year, the plant roots may be removed. Because Blackburn's sphinx moth larvae burrow into the substrate near host plants and may remain in a state of torpor for up to a year before emerging from the soil (USFWS 2005), soil disturbance at the base of the tobacco plants may harm Blackburn's sphinx moth larvae. The one-year period will ensure any larvae pupating in the soil will have pupated and emerged from soil prior to disturbance of the plant or soil.

During construction of the wells, waterline, and storage tanks, care should be taken to minimize the introduction of new weeds into the area. All vehicles, entering or leaving the construction site should be thoroughly cleaned (preferably pressure washed). If landscaping is included as part of the proposed water system, native plants should be employed to the maximum extent practicable. If native plants do not meet landscaping objectives, plants with a low risk of becoming invasive may be substituted.

Additional information can be gleaned from the following websites for use in selecting appropriate native species for landscaping: Native Plants Hawai'i (http://nativeplants.hawaii.edu/); Pacific Island Ecosystems at Risk (http://www.hear.org/Pier); and Weed Risk Assessments for Hawai'i and Pacific Islands (http://www.hpwra.org/).

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APPENDIX 1: List of Plant Species Observed

The following checklist is an inventory of all the plant species observed by SWCA biologists at the proposed Honua'ula private water system survey area in Kīhei-Mākena, Maui, Hawai'i. The plant names are arranged alphabetically by family and then by species into three groups: Ferns, Monocots, and Dicots. The taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (1999), Wagner and Herbst (2003), and Staples and Herbst (2005). Fern taxonomy follows Palmer (2003). Recent name changes are those recorded in the Hawaii Biological Survey series (Evenhuis and Eldredge 1999-2002).

Status:

E = endemic = native only to the Hawaiian Islands.
I = indigenous = native to the Hawaiian Islands and elsewhere.
P = Polynesian = introduced by Polynesians.
X = introduced/ alien = all those plants brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact (Cook's arrival in the islands in 1778).

Abundance Location:

Field = Proposed well field on Haleakalā Ranch land.
Dist/Tank = Proposed distribution line and tanks on 'Ulupalakua Ranch land.

Relative Site Abundance:

Abundant = forming a major part of the vegetation within the survey area.
Common = widely scattered throughout the area or locally abundant within a portion of the area.
Uncommon = scattered sparsely throughout the area or occurring in a few small patches.
Rare = only a few isolated individuals within the survey area.

Scientific Name	Hawaiian, Common Name(s)	Status	Abundance	
			Field	Dist/Tank
FERNS				
Adiantaceae				
Doryopteris decipiens (Hook.) J. Sm.	'iwa'iwa	E		Rare
MONOCOTS				
Aloeaceae				
Aloe vera (L.) Burm.f.	aloe	X		Rare

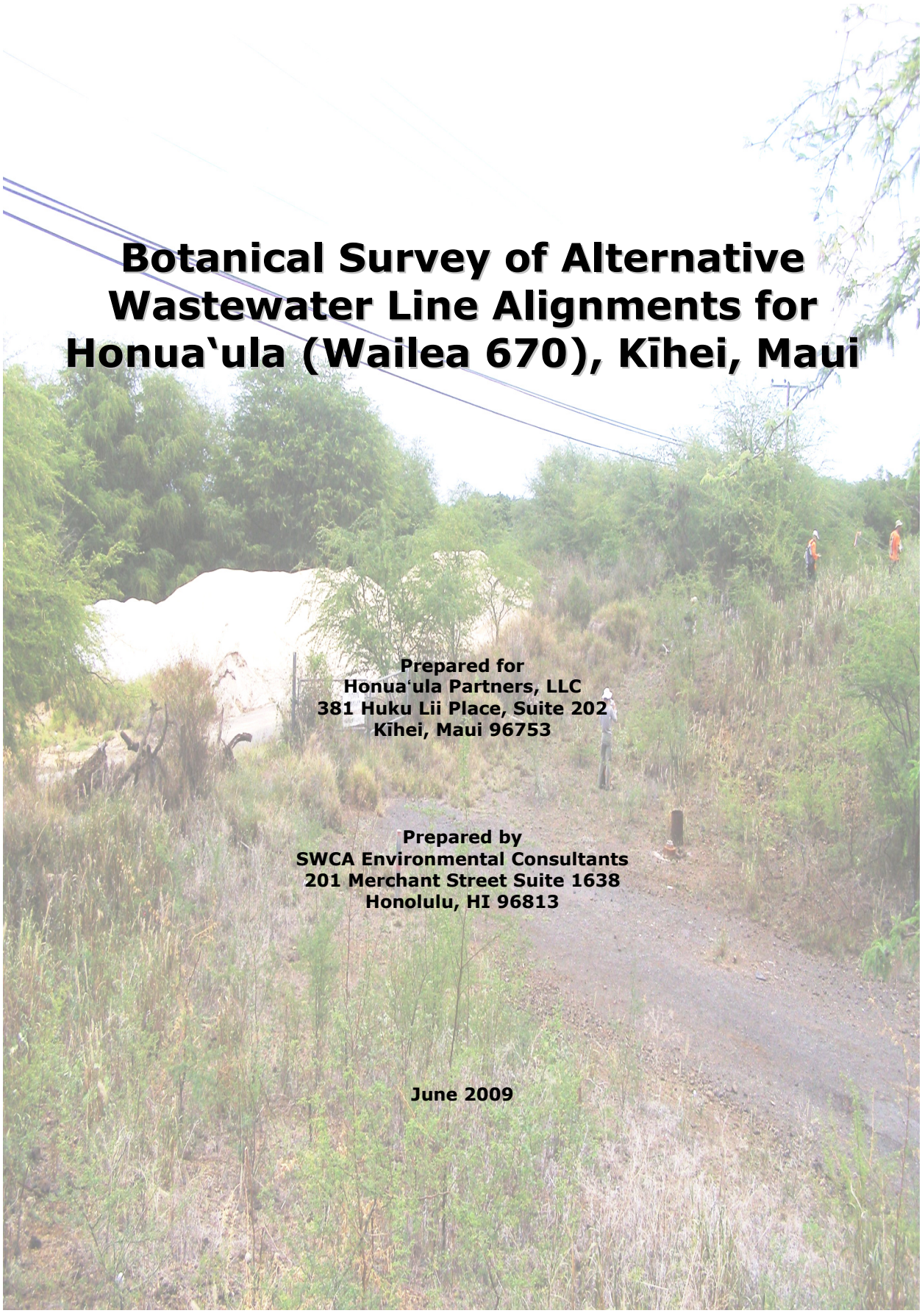
Scientific Name	Hawaiian, Common Name(s)	Status	Abundance	
			Field	Dist/Tank
Arecaceae				
Cocos nucifera L.	niu, ololani, coconut	P		Rare
Poaceae				
Cenchrus ciliaris L.	buffelgrass	X	Abundant	Abundant
Heteropogon contortus (L.) P.Beauv. ex Roem. & Schult.	pili, lule	I	Rare	Rare
Urochloa maxima (Jacq.) R.D. Webster	Guinea grass	X	Uncommon	Uncommon
DICOTS				
Asclepiadaceae				
Calotropis gigantea (L.) W.T.Aiton	crownflower, giant milkweed	X	Rare	
Tridax procumbens L.	coat buttons	X		Rare
Asteraceae				
Senecio madagascariensis Poiret	fireweed	X		Rare
*Verbesina encelioides (*Cav.) Benth. & Hook	golden crown beard	X		Rare
Bignoniaceae				
Spathodea campanulata P.Beauv.	African tulip tree	X		Rare
Cactaceae				
Opuntia ficus-indica (L.) Mill.	panini	X		Rare
Pilocereus royenii (L.) Byles & Rowley	Royen's tree cactus	X		Rare
Cucurbitaceae				
Momordica charantia L.	balsam pear, bitter melon	X		Rare
Euphorbiaceae				
Chamaesyce hypercifolia (L.) Millsp.	graceful spurge	X	Rare	Rare

Scientific Name	Hawaiian, Common Name(s)	Status	Abundance	
			Field	Dist/Tank
Fabaceae				
Erythrina sandwicensis O.Deg.	wiliwili	E	Rare	Rare
Indigofera suffritocosa Mill.	iniko	X	Rare	
Leucaena leucocephala (Lam.) de Wit	koa haole	X	Uncommon	Uncommon
Macroptilium lathyroides (L.) Urb.	wild bean, cow pea	X		Rare
Prosopis pallida (Humb. & Bonpl. Ex Willd.) Kunth	kiawe	X	Abundant	Abundant
Lamiaceae				
Leonotis nepetifolia (L.) R.Br.	lion's ear	X		Rare
Malvaceae				
Abutilon grandifolium (Willd.) Sweet	hairy abutilon, ma'o	X	Rare	Rare
Malvastrum coromandelianum (L.) Garcke	false mallow	X		Rare
Meliaceae				
Melia azedarach L.	chinaberry, pride-of-India	X		Rare
Papavaraceae				
Argemone glauca (Nutt. Ex Prain (Pope)	pua kala	E	Rare	
Plumbaginaceae				
Plumbago auriculata Lam.		X		Rare
Plumbago zeylanica L.	'ilie'e	I	Rare	
Solanaceae				
Nicotiana glauca R.C. Graham	tree tobacco	X	Uncommon	
Sterculiaceae				
Waltheria indica L.	'uhaloa	I	Uncommon	Rare
Verbenaceae				
Lantana camara L.	Sacramento bur	X	Rare	Rare

Appendix 4

Appendix 4

Botanical Survey of Alternative Wastewater Line Alignments for Honua'ula (Wailea 670), Kīhei, Maui



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1.0 INTRODUCTION

This report summarizes the findings of a botanical survey conducted by SWCA Environmental Consultants (SWCA) in August 2008 along three proposed alternative routes, for the conveyance of wastewater from the Honuaʻula Project site to the Makena Wastewater Reclamation Facility located on the Makena Resort property.

Honua'ula is located in the Wailea area of Kihei, Maui (Figure 1). In April 2008, R.M. Towill Corporation conducted a feasibility study for conveyance of wastewater from Honua'ula to the existing Makena Resort Wastewater Reclamation Facility (MRWRF), for treatment and disposal. This study by R. M. Towill investigated the following four alternative wastewater conveyance routes from Honua'ula to MWWRF on the Makena property.

Alternative A – pump directly to MWWRF
Alternative B – pump to a high point and gravity flow to MWWRF
Alternative C – gravity flow to MWWRF
Alternative D- gravity flow to the Makena Wastewater Pump Station (MWWPS) "MU"

R. M. Towill Corporation determined that alternative C was infeasible because the elevation difference did not allow for gravity flow from the Project Site to the MRWRF (R. M. Towill Technical Memorandum, 2008). SWCA conducted botanical surveys along the three feasible alternative routes A, B and D (Figure 2) between the Project site and MRWRF for the conveyance of wastewater and the return of treated water for non-potable re-use at Honua'ula.

The objectives of the botanical survey are:

- To identify and document the vegetation and all plant species within a 20 m-wide corridor along the three alternative wastewater line alignments;
- To map any State or Federally listed candidate, threatened or endangered plant species, species of concern and/ or rare (either locally or Statewide) plants within the study area.
- To recommend mitigation measures as appropriate to minimize impacts to native plants.

2.0 METHODS OF STUDY

Botanists Shahin Ansari Ph.D., Tiffany Thair (M.S. candidate), Maya Legrande M.S., and Talia Portner B.S. conducted plant surveys along each of the three alternative wastewater line alignments on August 8, 2008. A Trimble GeoXT mapping-grade GPS unit preloaded with the study transects was used to guide the survey and collect point data on native plants. The botanists walked the transects at 5-meter intervals to cover a 20-meter wide corridor along each of the three wastewater line alignments. The botanists thoroughly scanned each 5-m wide corridor and documented all plant species observed. We did not survey a portion of alternative route B that runs along the southern boundary of the Honua'ula project Site, because this section was previously surveyed by SWCA in March of 2008 as part of the botanical survey for the Wailea 670 parcel (SWCA 2008).

3.0 RESULTS

The botanists observed 84 plant species, including eight native species two of which are endemic and six are indigenous (Appendix 1). No federally listed threatened, endangered, or candidate plants were detected along any of the alternative wastewater line alignments.

Previous botanical surveys of Honuaʻula (Char and Linney 1988, 1993, 2004; SWCA 2009) reported that the vegetation along the southern border of the Honua'ula property is kiawe-wiliwili shrubland with scattered wiliwili, anuanu (*Sicyos pachycarpus*) and alena (*Boerhavia sp.*) (Figure 3). In this survey, all remaining areas surveyed consist of kiawe shrubland. Kiawe (*Prosopis pallida*) was the dominant canopy species along all three alternative routes (Figure 4). Some of the common herbs and shrubs included golden crown beard (*Verbesina encelioides*), *Bidens* species, false ragweed (*Parthenium hysterophorus*), klu (*Acacia farnesiana*), sweet basil (*Ocimum basilicum*), koa haole (*Leucena leucocephala*) and tree tobacco (*Nicotiana glauca*). Common

grasses found across the alternative conveyance routes include buffel grass (*Cenchrus ciliaris*), guinea grass (*Panicum maximum*), natal red top (*Melinus repens*) and sour grass (*Digitaria insularis*).

Alternative route 'A' extends for a length of 1940 linear m (6366 linear ft). About 753 m (2470 ft) of this route is adjacent to a paved road on the Makena property while the remaining 1187 m (3896 ft) runs through the kiawe shrubland and parts of the golf course on the Makena property (Figure 3). Alternative route 'A' requires the construction of a pump station (pump A, Figure 2) (Towill 2008) which would be located in the kiawe-wiliwili shrubland on the Honua'ula property (SWCA 2008) in the southwestern corner of the Honua'ula project site. Alternative route 'A' overlaps with route 'D' for 753 m (2470 ft) (Figure 3). Along the section where alternative routes 'A' and 'D' overlap, we found three native species, wiliwili (*Erythrina sandwicensis,* n=5), uhiuhi (*Senna gaudichaudii, n*=1) and maiapilo (*Capparis sandwichiana,* n=2). We also mapped thirty-three wiliwili trees at five locations towards the southern end of alternative route A (Figure 3 and 5).

Alternative route 'B' is 3212 linear m (10,538 linear ft) in length. Route 'B' would require the construction of two pump stations; pump A, and an additional pump station B (Figure 2) about 107 m (350 ft) to the east of pump A (Towill 2008). Location of pump B and the 856 m (2807 ft) stretch of route 'B' (Figure 2) runs through the kiawe-wiliwili shrubland (SWCA 2009) on the Honua'ula project site which inhabits the native species of wiliwili, anuanu (*Sicyos pachycarpus*) and alena (*Boerhavia sp.*) (Figure 3). The remaining 2356 m (7731 ft) of route B passes through the kiawe shrubland vegetation and parts of the golf course greens on the Makena property (Figure 2). Botanists found 14 wiliwili trees along the section of route 'B' that runs along the property line between Makena and the Lokelani Resort properties (Figure 3 and 6). They also found a clump of 11 to 15 individuals of hoary abutilon on Route B near the MRWRF (Figure 3).

Alternative route 'D' is 2027 linear m (6650 linear ft) in length. Similar to route 'A', the initial 753 m (2470 ft) of route 'D' also runs adjacent to a paved road on the Makena property. The remainder of 1274 m (4180 ft) of route 'D' runs through the kiawe shrubland and parts of the golf course before terminating at the 'MU' wastewater pump station (Figure 2 and 7). On the section of route 'D' that does not overlap with route 'A', we found one wiliwili tree and a clump of about 11 to 15 individuals of hoary abutilon (*Abutilon incanum*) close to the wastewater treatment plant (Figure 3 and 8).

4.0 DISCUSSION AND RECOMMENDATIONS

The construction and operation of any of the three alternative wastewater lines is not likely to have a major impact either on the vegetation or terrestrial ecosystems on either the Honua'ula or Makena parcels. The native species of plants found within the alternative wastewater line alignments are common throughout Maui and the other islands in the State. Ninety percent (90%) of the plants found on all three alternative alignments are introduced species.

Only a portion of alternative Route 'B' passes through the kiawe-wiliwili vegetation. This alternative requires the construction of two pump stations A and B, also within the kiawe-wiliwili vegetation. Construction of alternative Route 'A' is likely to disturb a greater number of native plant species. Alternative Route D is likely to have the least impact on the vegetation in general and on the native plants in particular.

- The the extent possible, as many wilwiliw trees as possible should remain undisturbed by construction. Where no alternative exists to removal of individual wiliwili trees, saplings can be propagated in areas adjacent to the wastewater lines, as appropriate.

- Non-native tree tobacco (*Nicotiana glauca*) trees, which occur along all three alternative wastewater line alignments, are host plants for the listed endangered Blackburn sphinx moth (*Manduca blackburni*). *M. blackburni* has been found on tree tobacco plants elsewhere in Kīhei and within Honua'ula (SWCA 2009). To help insure against the accidental take of individual sphinx moths, a qualified wildlife biologist should first screen each tree tobacco plant, prior to any land clearing. If sphinx moths or signs of sphinx moths (frass, cut stems or leaves,

caterpillars, pupae, or adults) are found on any tree, that tree should be marked and protected against disturbance, and the US Fish and Wildlife Service and Maui Office of the Department of Land and Natural Resources, Division of Forestry and Wildlife should be consulted.

- Landscaping following construction should focus on the use of native plant species normally found on adjacent lands. Suitable species may include, 'ilima (*Sida fallax*), ilie'e (*Plumbago zeylanica*), maiapilo (*Capparis sandwichiana*), uhiuhi (*Senna gaudichaudii*) and naio (*Myoporum sandwicensis*). Seeds or seedlings for these native plants may be obtained from various native plant nurseries on Maui such as Ho'olawa Farms or Native Nursery LLC.

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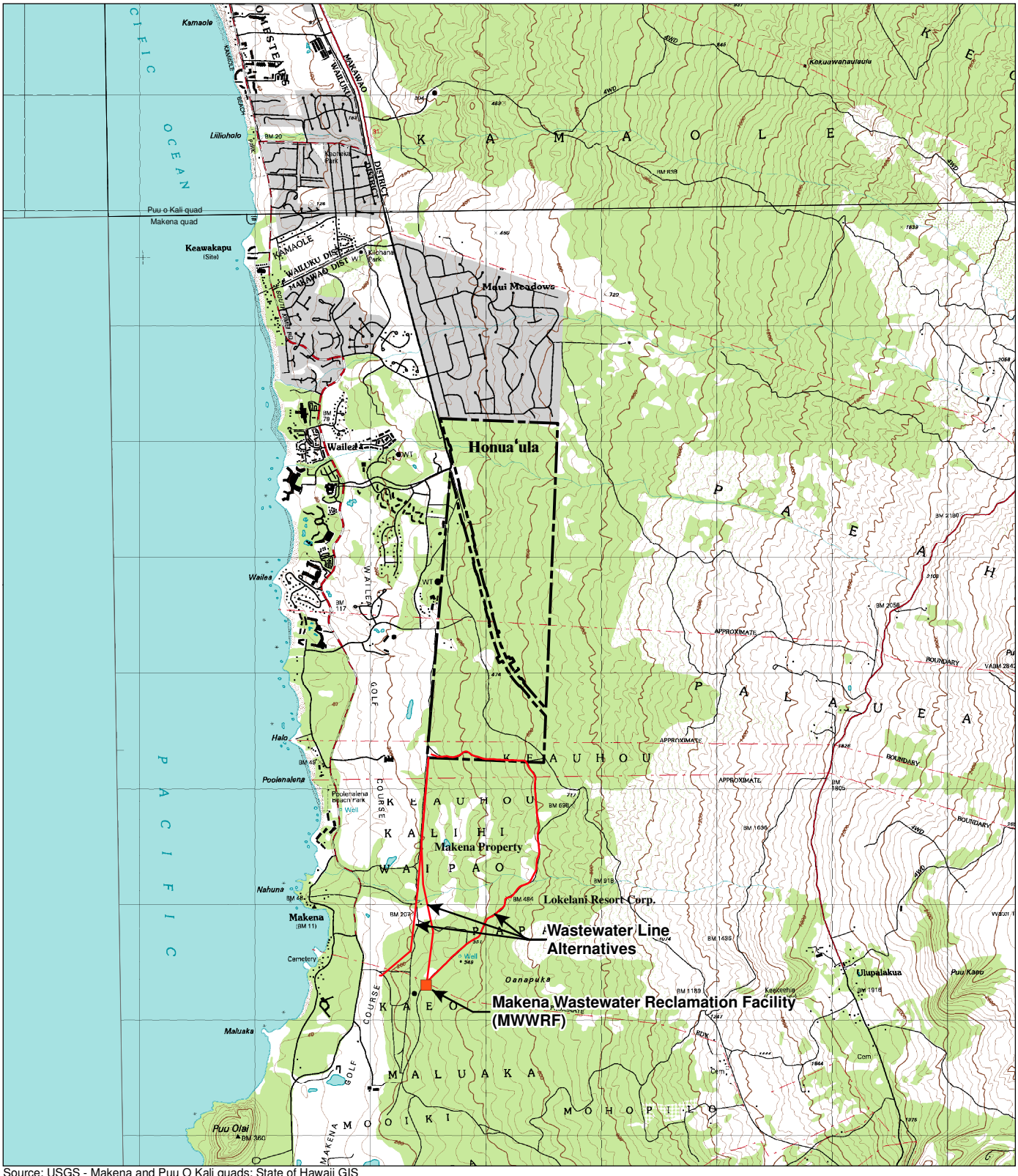


Source: USGS - Makena and Puu O Kali quads; State of Hawaii GIS

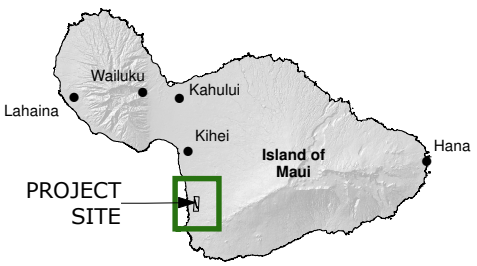


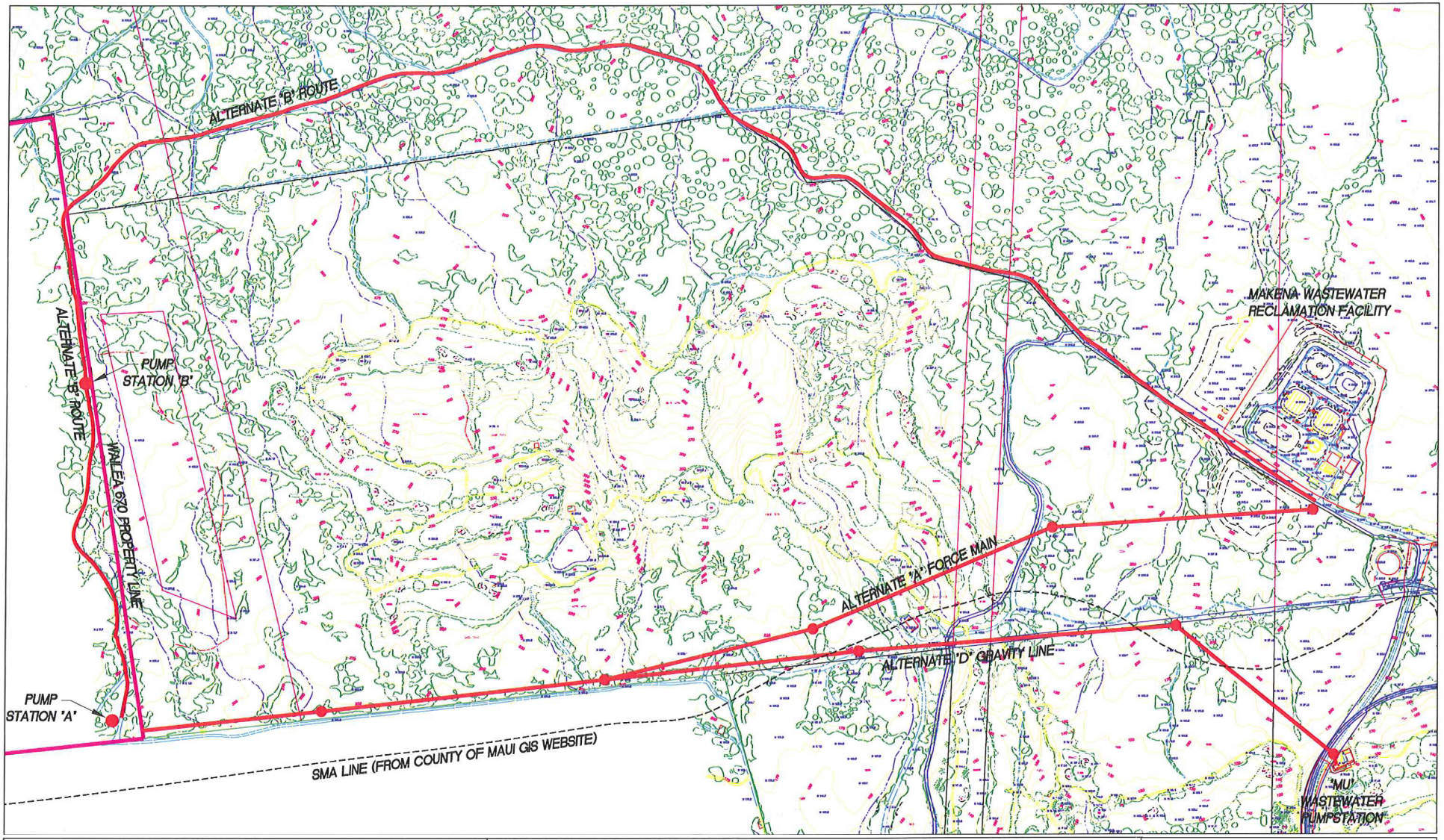
Figure 1
Location of Honua'ula Project Site

N

0 1,000 2,000 4,000 ft

0 250 500 1,000 M

SWCA
ENVIRONMENTAL CONSULTANTS



Planning – Engineering – Environmental Services – Photogrammetry – Surveying – Construction Management
R. M. TOWILL CORPORATION
808 842 1133 2024 North King Street Suite 200 Honolulu Hawaii 96819-3494

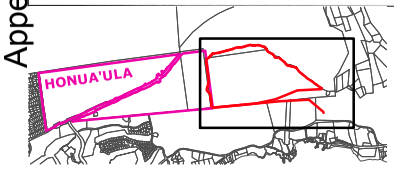
NOTES:
1. SCALE: 1"=200'.
2. CONTOUR INTERVAL: 5' & 2'.
3. VERTICAL DATUM: MEAN SEA LEVEL.
4. ORIGIN OF COORDINATES: HAWAIIAN PLANE COORDINATE SYSTEM ZONE 2).
5. COMPILED FROM PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPHY DATED 4-3-07 AT AN ALTITUDE OF 3,000' ABOVE MEAN TERRAIN.
6. ALL CONTOURS IN AREAS WHERE THE HEIGHT OF VEGETATION EXCEEDS FIVE FEET ARE TO BE INTERPRETED AS FORM LINES ONLY AND AS SUCH MAY BE SUBSTANDARD.

LEGEND
BUILDING
PAVED ROAD
UNPAVED ROAD
FENCE
WALL
POWER POLE
SEWER LINE
ACCESS SHAFT
INDEX CONTOUR
INTERMEDIATE CONTOUR
DEPRESSION CONTOUR
DRAIN LINE
SPOT ELEVATION
TREE, BUILDING, SHRUB
PALM TREE

GRAPHIC SCALE 200 0 100 200 400

Figure 2
Offsite Wastewater Line Alternatives Map

Appendix 4



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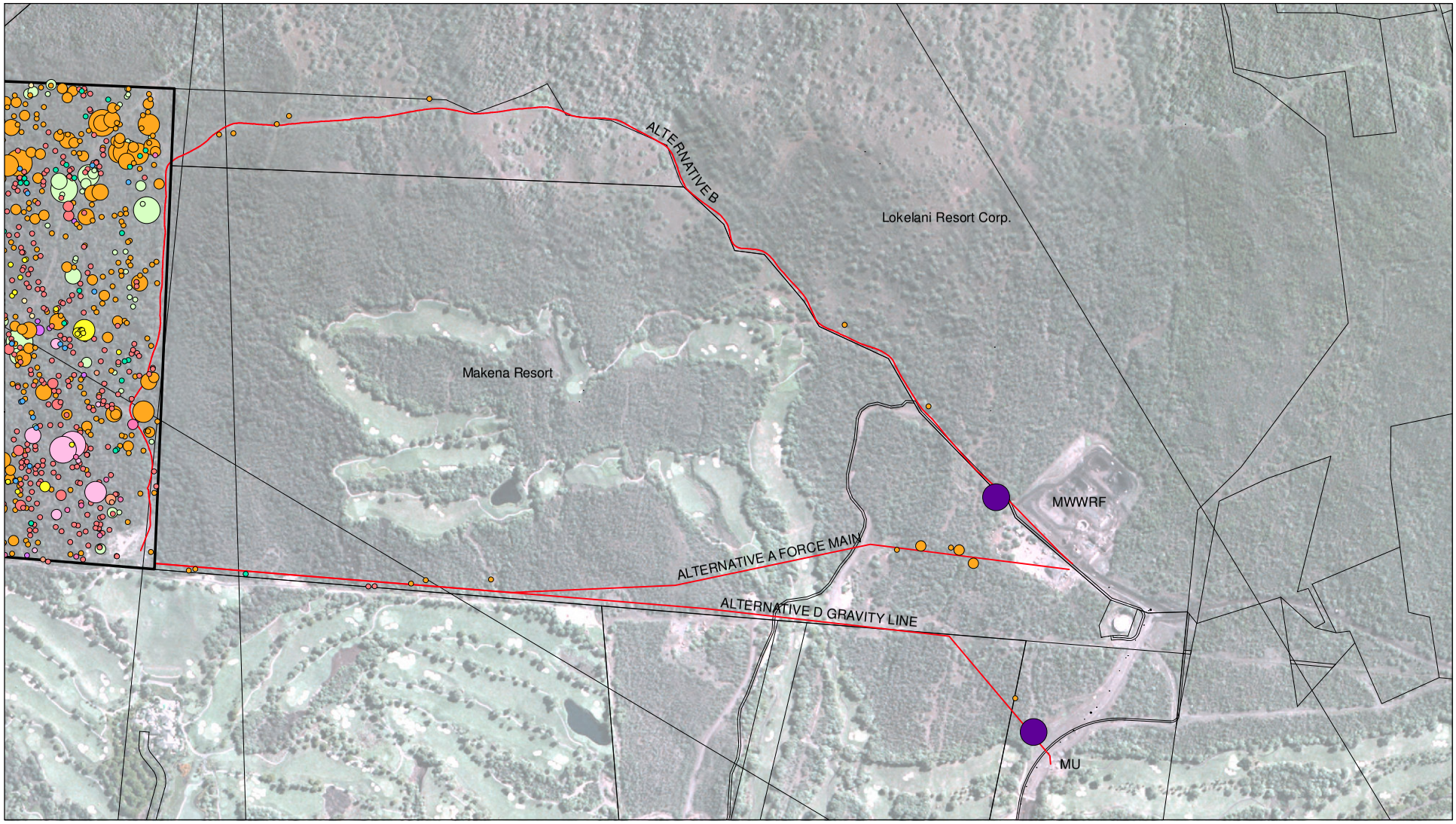


Appendix 4

Native Plants by Species

- *Argemone glauca*
- *Abutilon incanum*
- *Boerhavia sp.*
- *Canavalia pubescens*
- *Capparis sandwichiana*
- *Doryopteris decipiens*
- *Dodonea viscosa*
- *Erythrina sandwicensis*
- *Heteropogon contortus*
- *Ipomoea tuboides*
- *Lipochaeta rockii*
- *Myoporum sandwicense*
- *Senna gaudichaudii*
- *Sicyos hispidus*
- *Sicyos pachycarpus*

Native Plants by Count Classes

- 1 - 5
- 6 - 10
- 11 - 15
- 16 - 25
- 26 - 60
- 61 - 110

Plant Source: Native Plants were mapped with GPS
Boundary Source: PBR Hawaii
Aerial Source: PDC (Pacific Disaster Center)

Figure 3
Locations of Native Plants

N

0 250 500 1,000 ft

0 50 100 200 M

SWCA ENVIRONMENTAL CONSULTANTS

Figure 4. Kiawe shrubland was the typical vegetation type along route 'A' (above) and the other wastewater conveyance routes 'B' and 'D'.

A

B

Figure 5. Maiapilo (*Capparis sandwichiana*) (A) and uhiuhi (*Senna gaudiachaudii*) (B) adjacent to the paved road along the section where routes 'A' and 'D' overlap.

Figure 6. Grove of wiliwili (*Erythrina sandwicensis*) trees along wastewater conveyance route 'B'.

Figure 7. Vegetation along alternative wastewater conveyance route 'D' overlooking the waste water pump station.

Figure 8. Hoary abutilon (*Abutilon incanum*) on route 'D'.

APPENDIX 1. LIST OF PLANTS OBSERVED ON ALTERNATIVE WASTEWATER LINE ALIGNMENTS.

The taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (1999), Wagner and Herbst (1999), and Staples and Herbst (2005). Recent name changes are those recorded in the Hawaii Biological Survey series (Evenhuis and Eldredge, eds, 1999-2002). (✓) indicated species presence.

The following symbols are used:

E = endemic = native only to the Hawaiian Islands.
I = indigenous = native to the Hawaiian Islands and elsewhere.
X = introduced or alien = all those plants brought to the Hawaiian Islands by humans, intentionally or accidentally, after 1778.

Scientific Name	Common Name	Status	Alt B	Alt A	Alt D
AGAVACEAE					
Furcraea foetida (L.) Haw.	mauritius hemp, malina	X		✓	
ALOEACEAE					
Aloe vera (L.) N.L.Burm.	aloe	X	✓	✓	
COMMELINACEAE					
Commelina benghalensis L.	hairy honohono, dayflower	X		✓	
POACEAE					
Axonopus fissifolius (Raddi)Kuhlm.	narrow-leaved carpetgrass	X	✓		
Brachiaria mutica (Forssk.) Stapf	California grass	X		✓	
Cenchrus ciliaris L.	buffelgrass	X	✓	✓	✓

Appendix 4

Scientific Name	Common Name	Status	Alt B	Alt A	Alt D
Chloris barbata (L.) Sw.	swollen fingergrass	X	✓	✓	✓
Cynodon dactylon (L.) Pers	manienie	X	✓	✓	✓
Digitaria insularis (L.) Mez exEkman	sourgrass	X	✓	✓	✓
Melinus repens (Willd.) Zizka	natal redtop	X	✓	✓	✓
Panicum maximum L.	guinea grass	X	✓	✓	
Setaria verticillata (L.) P.Beauv.	bristly foxtail, mau'u pilipili	X	✓	✓	✓
ACANTHACEAE					
Asystasia gangetica (L.) T.Anderson	chinese violet	X		✓	
AMARANTHACEAE					
Alternanthera pungens Kunth	khaki weed	X	✓	✓	✓
Amaranthus spinosus L.	spiny amaranth	X	✓		
Amaranthus viridis L.	slender amaranth	X		✓	✓
ASCLEPIADACEAE					
Asclepias physocarpa (E.Mey.)Schltr.	balloon plant	X	✓	✓	✓
ASTERACEAE					

Appendix 4

Scientific Name	Common Name	Status	Alt B	Alt A	Alt D
Ageratum conyzoides L.	maile hohono, maile	X		✓	
Bidens cynapiifolia Kunth	Spanish needle, beggartick	X	✓	✓	✓
Bidens pilosa L.	Spanish needle	X	✓	✓	✓
Conyza bonariensis (L.) Cronq.	hairy horseweed	X	✓	✓	✓
Crassocephalum crepidioides(Benth.) S.Moore	crassocephalum	X		✓	
Emilia fosbergii Nicolson	red pualele	X	✓	✓	
Lactuca serriola L.	prickly lettuce	X		✓	
Parthenium hysterophorus L.	false ragweed, Santa Maria	X	✓	✓	✓
Pluchea carolinensis (Jacq.) G.Don	sourbush	X	✓	✓	
Pluchea indica (L.) Less.	Indian fleabane	X		✓	
Pluchea x *fosbergii* Coopper. &Galang	fleabane	X		✓	
Sonchus oleraceus L.	pualele	X	✓		
Sphagneticola trilobata (L.)Pruski	wedelia	X		✓	
Tridax procumbens (L.)	coat buttons	X	✓	✓	✓
Verbesina encelioides (Cav.)Benth. & Hook	golden crown-beard	X	✓	✓	✓

Appendix 4

Scientific Name	Common Name	Status	Alt B	Alt A	Alt D
Xanthium strumarium L. var.*canadense* (Miller)	kikania	X	✓	✓	
BORAGINACEAE					
Heliotropium procumbens Mill. var. *depressum* (Cham.) Fosberg		X	✓		
CACTACEAE					
Opuntia ficus-indica (L.) Mill.	panini	X	✓	✓	✓
CAPPARACEAE					
Capparis sandwichiana DC.	maiapilo	E		✓	
Cleome gynandra L.	wild spider flower	X	✓	✓	
CHENOPODIACEAE					
Atriplex semibaccata R.Br.	Australian saltbush	X	✓	✓	✓
Chenopodium murale L.	aheahea	X	✓		
CONVOLVULACEAE					
Ipomoea obscura (L.) Ker Gawl.		X	✓	✓	✓
Merremia aegyptia (L.) Urb.	hairy merremia	X	✓	✓	✓
CUCURBITACEAE					

Appendix 4

Scientific Name	Common Name	Status	Alt B	Alt A	Alt D
Coccinea grandis (L.) Voigt	ivy gourd	X	✓	✓	✓
Momordica charantia L.	balsam pear	X		✓	
EUPHORBIACEAE					
Chamaesyce hirta (L.) Millsp.	hairy spurge, garden spurge	X	✓	✓	✓
Chamaesyce hypercifolia (L.)Millsp.	graceful spurge	X		✓	
Chamaesyce hyssopifolia (L.)Small		X	✓		
Euphorbia heterophylla L.	kaliko	X		✓	
Ricinus communis L.	castor bean	X	✓	✓	✓
FABACEAE					
Acacia farnesiana (L.) Willd.	klu, aroma, kolu	X	✓	✓	✓
Chamaecrista nictitans (L.)Moench	partridge pea	X	✓	✓	✓
Crotalaria incana L.	fuzzy rattlepod	X	✓		
Crotalaria pallida Aiton	smooth rattlepod	X	✓	✓	
Desmanthus pernambucanus(L.) Thell.	slender or virgate mimosa	X	✓	✓	✓
*Erythrina sandwicensis*O.Deg.	wiliwili	E	✓		

Appendix 4

Scientific Name	Common Name	Status	Alt B	Alt A	Alt D
Indigofera suffritocosa Mill.	iniko	X	✓	✓	✓
Leucaena leucocephala (Lam.) de Wit	koa haole	X	✓	✓	✓
Macroptilium lathyroides (L.)Urb.	wild bean	X	✓	✓	
Pithecellobium dulce (Roxb.)Benth.	opiuma	X		✓	
Prosopis pallida (Humb. &Bonpl. Ex Willd.) Kunth	kiawe, algaroba	X	✓	✓	✓
Samanea saman (Jacq.) Merr.	monkeypod	X		✓	
Senna occidentalis (L.) Link	coffee senna	X		✓	
Senna gaudichaudii (Hook. &Arn.) H.S.Irwin & Barneby	kolomona, uhiuhi	I		✓	
LAMIACEAE					
Hyptis pectinata (L.) Poit.	comb hyptis	X	✓		
Leonotis nepetifolia (L.) R.Br.	lion's ear	X	✓	✓	✓
Ocimum basilicum L.	sweet basil	X	✓	✓	✓
MALVACEAE					
Abutilon grandifolium (Willd.)Sweet	hairy abutilon	X	✓	✓	✓
Abutilon incanum (Link.)Sweet	hoary abutilon	I	✓	✓	✓

Appendix 4

Scientific Name	Common Name	Status	Alt B	Alt A	Alt D
Malva parviflora L.	cheese weed	X	✓	✓	✓
Malvastrum coromandelianum(L.) Garcke	false mallow	X	✓	✓	✓
Sida fallax Walp.	ʻilima	I	✓	✓	✓
Sida spinosa L.	prickly sida	X	✓	✓	✓
NYCTAGINACEAE					
Boerhavia coccinea Mill.		X	✓	✓	✓
PASSIFLORACEAE					
Passiflora foetida L.	love-in-a-mist	X		✓	
PLUMBAGINACEAE					
Plumbago zeylanica L.	ʻilieʻe	I		✓	
PORTULACACEAE					
Portulaca oleracea L.	pigweed	X	✓	✓	✓
SOLANACEAE					
Datura stramonium L.	jimson weed	X	✓		
Nicandra physalodes (L.)Gaertn.	apple of Peru	X		✓	

Appendix 4

Scientific Name	Common Name	Status	Alt B	Alt A	Alt D
Nicotiana glauca R.C. Graham	tree tobacco	**X**	✓	✓	✓
Solanum americanum Mill.	glossy nightshade, popolo	**I**		✓	
Solanum lycopersicum L. var.*cerasiforme* (Dunal)Spooner, G.J. Anderson &R.K. Jansen	cherry tomato	**X**	✓	✓	✓
*Solanum seaforthianum*Andrews		**X**	✓	✓	
STERCULIACEAE					
Waltheria indica L.	'uhaloa	**I**	✓	✓	✓
TILIACEAE					
Triumfetta semitriloba Jacq.	Sacramento bur	**X**	✓	✓	✓
Verbenaceae					
Lantana camara L.	lākana	**X**	✓	✓	

Appendix 4

Appendix 4

Appendix 5

Appendix 5

HAWAI'I WILDLIFE CENTER
P.O. Box 551752
Kapa'au, HI 96755
808-345-8421
hawaiiwildlifecenter.org

Hawaii Wildlife Center – Functions and Services

HWC SITE

Wildlife treatment – triage, condition assessment, stabilization, physical care, quarantine, feeding, washing, drying, monitoring, recovery and release into the wild

Contingency planning for emergency response

Formalizing partnership and mitigation agreements

Emergency response training for Center staff, agency staff, interns, students, volunteers and researchers, to include oiled wildlife capture, handling and treatment; disease recognition and response (e.g. botulism, malaria, West Nile virus); wildlife handling and translocation

Internship program development and management

Public outreach and education programs (interpretive programs, docent-guided tours, special events)

Lab research (e.g. handling protocol, physiological norms, other parameters)

OFF SITE

Emergency response management, including site assessment, field training, mobilization, staff supervision, volunteer coordination, equipment/facilities management, wildlife capture, handling and transportation

Events to include oil/contaminant spills, seasonal fallout of birds, destruction of nesting sites, disease outbreaks, major weather/tsunami events, etc.

Translocation project consultation and management, including planning, equipment preparation, staff/volunteer training, wildlife capture, captive care, transportation and release

Expert consultation to assess and mitigate adverse impacts of proposed projects on native wildlife

Wildlife research and management services (e.g. native species biology, wildlife surveys, habitat management and restoration, management planning, etc.)

Leadership of field visits and ecotours to promote public awareness of wildlife conservation

Appendix 5

Appendix 6

Enclosure

U.S. Fish and Wildlife Service
Recommended Standard Best Management Practices

The U.S. Fish and Wildlife Service recommends that the following measures be incorporated into projects to minimize the degradation of water quality and impacts to aquatic fish and wildlife resources:

a. Turbidity and siltation from project-related work will be minimized and contained to within the vicinity of the site through the appropriate use of effective silt containment devices and the curtailment of work during adverse weather conditions;

b. Dredging and filling in the aquatic environment will be designed to avoid or minimize the loss special aquatic site habitat (pool/riffle areas, wetlands, etc.) and the unavoidable loss of such habitat will be compensated for;

c. All project-related materials and equipment (dredges, barges, backhoes, etc.) to be placed in the water will be cleaned of pollutants prior to use;

d. No project-related materials (fill, revetment rock, pipe, etc.) will be stockpiled in the water (stream channels, wetlands, etc.);

e. All debris removed from the aquatic environment will be disposed of at an approved upland or ocean dumping site;

f. No contamination (trash or debris disposal, alien species introductions, etc.) of adjacent aquatic environments (stream channels, wetlands, etc.) will result from project-related activities;

g. Fueling of project-related vehicles and equipment should take place away from the water and a contingency plan to control petroleum products accidentally spilled during the project will be developed. Absorbent pads and containment booms will be stored on-site, if appropriate, to facilitate the clean-up of accidental petroleum releases;

h. Any under-layer fills used in the project will be protected from erosion with (rock, core-loc units, etc.) as soon after placement as practicable; and

i. Any soil exposed near water as part of the project will be protected from erosion (with plastic sheeting, filter fabric, etc.) after exposure and stabilized as soon as practicable (with vegetation matting, hydroseeding, etc.).

Appendix 6

Appendix 7

DRAFT Honua`ula Emergency Response Protocol for Threatened and Endangered Species at the Property.

As part of the HCP process, Honua`ula will implement the following protocol for any injured or deceased threatened or endangered bird species on the property, including but not limited to Nēnē (Hawaiian goose), ae'o (Hawaiian stilt), 'alae ke'oke'o (Hawaiian coot)'alae 'ula (Hawaiian moorhen), or koloa (Hawaiian duck).

1. Emergency Contacts

Upon discovery of an injured bird, or a bird, egg, or nest in imminent danger, or carcass of a threatened or endangered species, all work in the area should be stopped immediately. Honua`ula staff should immediately contact the Natural Resources Manager, *and* the Maui Division of Forestry & Wildlife (DOFAW) Wildlife Management Staff, as listed below. If the first contact on the priority list is not available, leave a voicemail message, but then call the next person on the contact list. It is essential that person-to-person contact be made with Maui DOFAW staff.

1. John Medeiros
2. Fern Duvall

If unable to reach the Maui DOFAW contacts identified above, call Maui Police Dispatch and request that they contact "Wildlife". If the Maui DOFAW staff cannot be reached in an emergency, the closest State- permitted wildlife rehabilitator should be contacted:

The Maui DOFAW Wildlife Management staff, or if they cannot be reached, the closest State-permitted wildlife rehabilitator, have authority to make decisions concerning the disposition and care of injured birds. DOFAW has the authority to make decisions concerning the disposition and care of birds, eggs, or nests in imminent danger. In case of emergency, their direction should be followed immediately, without further consultation. (See Item III below for details).

After contacting the Natural Resources Manager, and the Maui DOFAW staff, or in the case that Maui DOFAW staff cannot be reached, the closest State-permitted wildlife rehabilitator, Honua`ula staff or their designated representative should notify the DOFAW HCP Coordinator (808-347-6740) or Wildlife Manager (808-227-3403), and the USFWS HCP Coordinator (Jeff Newman, office: 808-792-9442, cell: 808-551-5122) or USFWS Office of Law Enforcement (Keith Swindle, 808-791-0853) to inform them of the situation, and what action has been taken. Such notification to the USFWS is required by federal regulation. Emergency response should proceed as directed by the Maui DOFAW Wildlife Management staff, and should not wait for notification of these additional contacts.

2. Procedures for Handling Injured Birds and Bird Carcasses

Federal and State permits, or other appropriate Federal and State authorization, are required for any person handling live or dead specimens. Injured or ill protected species may only be captured and handled by personnel who have been trained in the capture and collection and after approval is received from USFWS and DOFAW personnel.

A. Equipment

The following equipment will be needed for use in responding to injured or dead birds:

- Pet carriers – 1 large
- Pieces of artificial turf/outdoor carpeting to place on floors of pet carriers
- Gloves
- Digital camera
- Large plastic bags (4+)

B. Procedures for Injured or Ill Birds
If an injured or ill bird cannot fly, do not immediately remove it from the field. Notify Maui DOFAW Wildlife Management staff or the nearest State-permitted wildlife rehabilitator as soon as possible, as described in Section I. Mark the area and monitor the bird if possible until DOFAW staff arrive. Record the following information, and photograph the bird (if possible):

1. Date
2. Location
3. Band numbers (if banded)
4. Condition of bird (e.g., type of injury). Be specific in describing injury type, and location on bird. Also indicate if a predator is evident in the vicinity. All reasonable measures to eliminate the predator should be taken.
5. Additional comments
6. Name, address, and telephone number of observer

Injured birds may be captured only by personnel trained and authorized for the capture and collection of live birds. The following procedures must be employed:

1. Gently pick up and place bird into carrier equipped with turf/carpet. Place only one bird in a carrier.
2. Mark exact spot of find(s) with tent stake(s)
3. Transport the bird pursuant to instructions received from DOFAW or USFWS, as described above.

The DOFAW HCP Coordinator (or Wildlife Manager), and the USFWS HCP Coordinator should be contacted , to inform them of the situation, and what action has been taken. Emergency response should proceed as directed by the Maui DOFAW Wildlife Management staff, and should not wait for notification of these additional contacts.

C. Procedures for Dead Birds and Disturbed Nests
Dead birds and disturbed nests must be left in place. Notify Maui DOFAW Wildlife Management staff and USFWS Law Enforcement (cell: 808-221-3558 or office: 808-791-0853), as soon as possible. Mark the area and monitor the bird or nest until DOFAW personnel arrive. If DOFAW is unable to respond, The natural Resources Manager of designated staff may receive verbal permission from DOFAW or USFWS to place the specimen in a sealed plastic bag, transport the carcass to a refrigerator for later retrieval, after they record the following information:

1. Date
2. Location (collection site)
3. Band numbers (if banded)
4. Condition of bird (e.g., type of injury)
5. Whether the bird was found dead, or died subsequent to discovery
6. Additional comments
7. Name, address and telephone number of observer
8. Photograph showing, at a minimum, the condition and location of the bird, nest, or eggs

Honua`ula will cooperate with Maui DOFAW and USFWS staff in their investigations of any dead birds or disturbed nests, and follow their direction.
The DOFAW HCP Coordinator (or Wildlife Manager), and the USFWS HCP Coordinator should be contacted, to inform them of the situation, and what action has been taken. Emergency and/or law enforcement response should proceed as directed by DOFAW and/or USFWS Law Enforcement staff, and should not wait for notification of these additional contacts.

3. Procedures for Birds, Nests, or Eggs in Imminent Danger

If Honua`ula staff observe or are informed of any birds, nests, or eggs of threatened or endangered species in imminent danger unrelated to construction-related activities, they will immediately contact Maui DOFAW Wildlife Management staff. DOFAW has the authority to make decisions concerning the disposition and care of birds, eggs, or nests in imminent danger. In case of emergency, their direction should be followed immediately, without need for additional consultation.
In these situations if eggs or nests are to be manipulated: (1) prior to cross-fostering attempts, confirm synchrony between foster female and egg(s) to be moved, and (2) all attempts will be made to avoid splitting eggs of a single clutch among multiple foster parents.
Details of the incident, including documentation and description of the subsequent management action, will be reported by Honua`ula to the DOFAW and USFWS HCP Coordinators.

IV. Modifications

This protocol may be modified if new biological information becomes available or by agreement among the DOFAW and USFWS.

Appendix 7

Appendix 8

CHEKCLIST OF PLANTS REPORTED FROM HONUA'ULA AND ULUPALAKUA-KANAIO PARCELS

Checklist includes plants reported from Honua'ula by Char and Linney (1988), Char (1993, 2004), Altenberg (2007), and SWCA (2010); and for Ulupalakua by Medeiros et al. (2003) plant inventory of Kanaio NAR. Plant names appear alphabetically by family and then by species into each of three groups: Ferns and Fern Allies (Pteridophytes), Monocots, and Dicots. The taxonomy and nomenclature of the flowering plants are based on Wagner et al. (1999), Wagner and Herbst (1999), and Staples and Herbst (2005). Recent name changes are those recorded in the Hawaii Biological Survey series (Evenhuis and Eldredge, eds, 1999-2002). The list includes scientific name with author citation, common English and/or Hawaiian name(s), and biogeographic status.

KEY to biographic status: E = endemic (occurring only in the Hawaiian Islands); I = indigenous (native to the Hawaiian Islands and elsewhere); X = introduced or alien (all those plants brought to the Hawaiian Islands after 1778). O indicates that the species was observed by SWCA; R indicates species was reported by others.

KEY to site occurrence: O = observed during recent SWCA surveys, R = recorded during previous non-SWCA surveys.

Scientific Name	Common Name	Status	Site	
			Honua'ula	Ulupalakua
PTERIDOPHYTES				
Adiantaceae				
Adiantum capillus-veneris L.	maiden-hair fern	I	R	
Doryopteris decipiens (Hook.) J. Sm.	*iwaiwa*	E	O	O
Pellaea ternifolia (Cav.) Link	pellaea	I	R	O
Aspleniaceae				
Asplenium adiantum-nigrum		I		R
Asplenium praemorsum		I		R
Nephrolepis multiflora (Roxb.) F.M. Jarrett ex. C.V. Morton	sword fern	X	R	O
Dennstaediaceae				

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Pteridium aquilinum var. decompositum		E		R
Dryopteridaceae				
Dryopteris unidentata		E		R
Polypodiaceae				
Pleopeltis thunbergiana		I		R
Polhypodium pellucidum		E		R
Psilotaceae				
Psilotum nudum	*moa*	I		O
Pteridaceae				
Pityrogramma austroamericana		X		R
MONOCOTS				
Agavaceae				
Furcraea foetida (L.) Haw.	*malina*	X	O	
Pleomele auwahiensis	*hala pepe*	E		O
Cannaceae				
Canna indica L.	indian shot	X	R	
Commelineaceae				
Commelina benghalensis L.	hairy *honohono*	X	O	

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Commelina diffusa N.L. Burm.	blue day flower	X	R	
Cyperaceae				
Carex wahuensis		E		O
Cyperus gracilis		X		R
Cyperus hillebrandii		E		R
Liliaceae				
Crinum sp.	crinum	X	R	
Yucca sp.	yucca	X	R	
Poaceae				
Bothriochloa pertusa (L.) A. Camus	hurricane grass	X	R	R
Brachiara subqudripa (Trin.) A.S. Hitchc	brachiara	X	R	
Cenchrus agrimoniodes var. agrimoniodes		E		R
Cenchrus ciliaris L.	buffelgrass	X	O	O
Cenchrus echinatus L.	sandbur	X	R	O
Chloris barbata (L.) Sw.	swollen finger grass	X	O	
Chloris radiata (L.) Sw.	plush finger grass	X	R	
Cynodon dactylon (L.) Pers	*manienie*	X	O	
Digitaria ciliaris (Retz.) Koeler	Henry's crab grass	X	R	R

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Digitaria insularis (L.) Mez ex Ekman	sour grass	X	O	
Digitaria radicosa (Presl.) Miq.	digitaria	X	R	
Digitaria sp.	crab grass	X	R	
Eleusine indica (L.) Gaertn.	goose grass	X	R	
Eragrostis cilianensis (All.) Vign. ex Janchen	stink grass	X	R	
Eragrostis tenella (L.) Beauv. ex R. & S.	love grass	X	R	
Eragrostis variabilis		E		R
Eragrostis sp.	eragrostis	X	R	
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	*pili* grass	E	O	
Melinis minutiflora	molasses grass	X		O
Panicum maximum L.	guinea grass	X	O	R
Panicum pellitum	*kai`oi`o*	E		O
Panicum torridum Gaud.	*kakonakona*	E	R	
Pennisetum clandestinum	kikuyu grass	X		O
Pennisetum purpureum	elephant grass	X		O
Rhynchelytrum repens (Willd.) Hubb.	natal red top	X	O	O
Setaria verticillata (L.) P. Beauv.	*mauʻu pilipili*	X	R	
Sporobolus africanus	african dropseed	X		O

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Tragus berteronianus J.A. Schultes	goat grass	X	R	
Urochloa subquadripara (Trin.) R. Webster	signal grass	X	R	
Zoysia sp.	zoysia	X	R	

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
DICOTS				
Amaranthaceae				
Amaranthus spinosus L.	spiny amaranth	X	O	O
Nototrichium sandwicense		E		R
Anacardiaceae				
Schinus terebinthifolius		X		R
Apiaceae				
Foeniculum vulgare		X		R
Petroselinum crispum	parsley	X		O
Apocynaceae				
Alyxia oliviformis		E		R
Rauvolfia sandwicensis	*hao*	E		O
Araliaceae				
Reynoldsia sandwicensis		E		O
Asclepiadaceae				
Asclepias curassavica		X		R
Asclepias physocarpa (E.Mey.) Schltr.	balloon plant	X	O	O
Stapelia gigantea (N.E. Brown)	zulu giant	X	O	

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Asteraceae				
Ageratina adenophora		X		R
Ageratina riparia		X		R
Ageratum conyzoides L.	*maile hohono*	X	O	R
Bidens cynapiifolia Kunth	beggar tick	X	O	
Bidens pilosa L.	spanish needle	X	O	O
Calyptocarpus vialis Less.	straggler daisy	X	O	
Centaura melitensis L.	star thistle	X	O	
Cirsium vulgare (Savi) Ten.	bull thistle	X	O	R
Conyza bonariensis (L.) Cronq.	hairy horseweed	X	R	O
Conyza canadensis (L.) Cronq.	horseweed	X	O	
Crassocephalum crepidioides (Benth.) S.Moore		X	O	
Dubautia linearis subsp. linearis		E		R
Emilia fosbergii Nicolson	red *pualele*	X	R	O
Galinsoga parviflora Cav.		X	R	O
Gamochaeta purpurea	purple cudweed	X		O
Gnaphalium cf*. japonicum* Thunb.	cudweed	X	R	R
Heterotheca grandiflora		X		R

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Hypochoeris glabra		X		O
Hypochoeris radicata		X		R
Hypochoeris sp. L.	cat's ear	X	R	O
Lactuca serriola L.	prickly lettuce	X	O	R
Lipochaeta rockii Sherff	*nehe*	E	O	
Parthenium hysterophorus L.	false ragweed	X	O	
Pluchea symphytifolia		X		R
Pseudognaphalium sandwicensium var. sandwicensium		E		R
Sigesbeckia orientalis L.		X	R	R
Sonchus asper (L.) J. Hill	spiny snowthistle	X	R	R
Sonchus oleraceus L.	*pualele*	X	O	
Sphagneticola trilobata (L.) Pruski	wedelia	X	O	
Synedrella nodiflora (L.) Gaertn.	node weed	X	R	O
Tridax procumbens L.	coat buttons	X	O	O
Verbesina encelioides (Cav.) Benth. & Hook	golden crown beard	X	O	O
Vernonia cinerea		X		R
Wollastonia lavarum		E		R
Xanthium strumarium L. var. *canadense* (Miller)	cocklebur	X	R	R

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Zinnia peruviana (L.) L.	wild zinnia	X	O	R
Brassicaceae				
Capsella bursa-pastoris	shepherd's purse	X		O
Cornopus didymus (L.) Sm.	wart cress	X	R	
Lepidium virginicum	pepperwort	X		O
Sisymbrium officinale	hedge mustard	X		O
Cactaceae				
Opuntia ficus-indica (L.) Mill.	*panini*	X	O	O
Pilocereus royenii (L.) Byles & Rowley	Royen's tree cactus	X	O	
Capparaceae				
Capparis sandwichiana DC.	maiapilo	E	O	R
Cleome gynandra L.	spider flower	X	R	
Caryophyllaceae				
Arenaria serpyllifolia		X		R
Polycarpon tetraphyllum (L.) L.		X	R	R
Silene gallica		X		O
Chenopodiaceae				
Chenopodium ambrosioides		X		R

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Chenopodium carinatum R.Br.		X	O	
Chenopodium murale L.	*aheahea*	X	O	
Chenopodium oahuense		E		O
Convolvulaceae				
Bonamia menziesii		E		R
Dichondria repens J. R. & G. Forst.		X	R	
Ipomoea indica (J. Burm.) Merr.	*koali awahia*	I	O	O
Ipomoea obscura (L.) Ker Gawl.	yellow bindweed	X	O	
Ipomoea tuboides (Degener & Ooststr.)	Hawaiian moon flower	E	O	O
Jacquemontia ovalifolia		E		R
Merremia aegyptia (L.) Urb.		X	O	
Crassulaceae				
Kalanchoe pinnata		X		O
Cucurbitaceae				
Cucumis dipsaceus (Ehrenb. ex Spach	wild cucumber	X	O	O
Momordica charantia L.	bitter melon	X	O	O
Sicyos hispidus Hillebr.	*ʻanunu*	E	O	
Sicyos pachycarpus Hook. & Arnott	*ʻanunu*	E	O	O

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Ebenaceae				
Diospyros sandwicensis		E		O
Epacridaceae				
Styphelia tamciameiae		I		O
Euphorbiaceae				
Aleurites moluccana		X		R
Antidesma pulvinatum		E		R
Chamaesyce celastroides var. lorifolia (A. Gray) Degener & I. Degener	*ʻakoko*	E	R	R
Chamaesyce hirta (L.) Millsp.	hairy spurge	X	O	O
Chamaesyce hypercifolia (L.) Millsp.	graceful spurge	X	R	
Euphorbia heterophylla L.	*kaliko*	X	O	
Euphorbia peplus		X		R
Phyllanthus tenellus Roxb.		X	O	
Ricinus communis L.	castor bean	X	O	O
Fabaceae				
Acacia farnesiana (L.) Willd.	klu	X	O	O
Acacia koaia		E		R
Bauhinia blakeana Dunn	orchid tree	X	R	

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Calopogonium mucunoides Desv.		X	R	
Cannavalia pubescens Hook. & Arnott	*ʻawikiwiki*	E	O	
Cassia fistula L.	golden shower	X	R	
Chamaecrista nictitans (L.) Moench	partridge pea	X	O	R
Crotalaria incana L.	fuzzy rattlepod	X	R	R
Crotalaria pallida Aiton	smooth rattlepod	X	R	
Desmanthus virgatus (L.) Willd.	virgate mimosa	X	O	
Desmodium incanum		X		R
Desmodium sandwicense		X		R
Desmodium tortuosum (Sw.) DC.	beggar weed	X	R	
Desmodium triflorum		X		R
Erythrina sandwicensis O.Deg.	*wiliwili*	E	O	O
Indigofera suffritocosa Mill.	*iniko*	X	O	O
Leucaena leucocephala (Lam.) de Wit	*koa haole*	X	O	R
Macroptilium lathyroides (L.) Urb.	wild bean	X	O	O
Mimosa pudica		X		O
Neonotonia wightii		X		O
Prosopis pallida (Humb. & Bonpl. Ex Willd.) Kunth	*kiawe*	X	O	

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Samanea saman (Jacq.) Merr	monkey pod	X	R	
Senna alata (L.) Roxb	candle bush	X	R	
Senna gaudichaudii (Hook. & Arn.) H.S.Irwin & Barneby	*kolomona*	I	O	
Senna occidentalis (L.) Link	coffee senna	X	R	
Sophora chrysophylla		E		R
Tephrosia purpurea		X		R
Triflorum repens		X		R
Vigna o-wahuensis		E		R
Flacourtiaceae				
Xylosma hawaiiense		E		R
Gentianaceae				
Centaurium erythraea		X		R
Lamiaceae				
Leonotis nepetifolia (L.) R. Br.	lion’s ear	X	O	
Ocimum basilicum L.	sweet basil	X	O	
Ocimum gratissimum L.	basil	X	O	
Plectranthus parviflorus		I		O
Salvia coccinea		X		O

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Salvia occidentalis		X		R
Stachys arvensis L.	stagger weed	X	R	
Lauraceae				
Cinnamomum camphora		X		R
Malvaceae				
Abutilon grandifolium (Willd.) Sweet	*maʻo*	X	O	O
Abutilon incanum (Link.) Sweet	hoary abutilon	I	O	
Malva parviflora L.	cheese weed	X	O	O
Malvastrum coromandelianum (L.) Garcke	false mallow	X	R	O
Sida fallax Walp.	*ʻilima*	I	O	O
Sida rhombifolia L.		X	R	O
Meliaceae				
Melia azedarach L.	Chinaberry	X	O	
Menispermaceae				
Cocculus orbiculatus		I		O
Moraceae				
Ficus elastica Roxb.ex Hornem	rubber tree	X	R	
Ficus microcarpa L. f.	Chinese banyan	X	O	

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Myoporaceae				
Myoporum sandwicensis A. Gray	*naio*	E	O	O
Myrsinaceae				
Myrsine lanaiensis		E		O
Myrtaceae				
Metrosideros polymorpha		E		R
Psidium guajava L.	guava	X	R	R
Nyctaginaceae				
Boerhavia acutifolia (Choisy) J.W. Moore	*alena*	I	O	
Boerhavia coccinea Mill.		X	R	O
Boerhavia herbstii Fosb.	*alena*	E	R	O
Boerhavia repens L.	*alena*		O	
Boerhavia sp.		I?		O
Mirabilis jalapa L.	four-o' clock	X	R	R
Oleaceae				
Nestegis sandwicensis		E		O
Oxalidaceae				
Oxalis corniculata L.	wood sorrel	X	O	O

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Papavaraceae				
Argemone glauca (Nutt. Ex Prain (Pope)	*pua kala*	E	O	O
Argemone mexicana L.	prickly poppy	X	O	
Bocconia frutescens L.		X	O	O
Eschscholzia californica Cham.	California poppy	X	O	
Hunnemannia fumarifolia		X		R
Passifloraceae				
Passiflora foetida L.	love-in-a-mist	X	R	
Passiflora subpeltata Ort.	passion flower	X	O	R
Piperaceae				
Peperomia leptostachya		I		R
Peperomia tetraphylla		I		R
Plantaginaceae				
Plantago lanccolata		X		O
Plantago major		X		O
Plumbaginaceae				
Plumbago zeylanica L.	*ʻilieʻe*	I	O	R
Polygonaceae				

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Antigonon leptopus H. & A.	coral vine	X	R	
Rumex acetosella		X		R
Portulacaceae				
Portulaca oleracea L.	pigweed	X	O	R
Portulaca pilosa L.	*ʻakulikuli*	X	O	O
Primulaceae				
Anagallis arvensis		X		O
Anagallis viscosa L.	scarlet pimpernel	X	R	
Proteaceae				
Grevillea robusta		X		R
Rhamnaceae				
Alphitonia ponderosa		E		R
Rosaceae				
Osteomeles anthyllidifolia		I		O
Rubiaceae				
Psychotria mauiensis		E		R
Psydrax odoratum		I		O
Rutaceae				

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Melicope adscendens		E		R
Melicope hawaiensis		E		R
Melicope knudsenii		E		R
Melicope mucronulata		E		R
Santalaceae				
Santalum ellipticum		E		O
Santalum freycinetianum var. lanaiense		E		R
Sapindaceae				
Dodonaea viscosa Jacq.	*ʻaʻaliʻi*	I	O	O
Sapotaceae				
Nesoluma polynesicum		E		R
Pouteria sandwicensis		E		O
Scrophulariaceae				
Veronica arvensis		X		R
Solanaceae				
Capsicum annum L.	chili pepper	X	O	
Datura stramonium L.	jimson weed	X	R	R
Lycopersicon pimpinellifolium (Jusl.)	currant tomato	X	O	

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Nicandra physalodes (L.) Gaertn.	apple of Peru	X	R	
Nicotiana glauca R.C. Graham	tree tobacco	X	O	O
Nothocestrum latifolium		E		O
Physalis peruviana		X		O
Solanum americanum Mill.	*popolo*	I	O	O
Solanum linnaeanum		X		O
Solanum seaforthianum Andrews		X	O	
Sterculiaceae				
Waltheria indica L.	*ʻuhaloa*	I	O	O
Thymelaeaceae				
Wikstroemia monticola		E		O
Tiliaceae				
Triumfetta semitriloba Jacq.	Sacramento bur	X	O	O
Verbenaceae				
Lantana camara		X	O	O
Stachytarphela cayennensis		X		O
Verbena littoralis		X		O
Viscaceae				

Scientific Name	Common Name	Status	Site	
			Honuaʻula	Ulupalakua
Korthalsella cylindrica		E		R

DRAFT

Honua'ula Mitigation Budget for 15-Year Incidental Take Licences for Blackburn's sphinx moth and Hawaiian goose

On-Site Mitigation Associated With the 40 acre Native Plant Preservation Area (Easement), 8 acre native plant conservation area, and 28 acres of natural gulch vegetation (All On-Site Mitigation costs are considered part of Direct Construction Costs of Project)	[1] Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Subsequent Years (9)	Permit Total	Annual Cost Year 16 Forward
Easement for 40 acre Plant Preservation Area	[2] Provided							$0	
Fence eastern and southern project area boundaries for ungulates	$450,000	$3,000	$3,000	$3,000	$3,000	$3,000	$27,000	$492,000	$3,000
Fence native plant preserve easement with natural stone wall		$300,000					$0	$300,000	
Remove deer, goats, cattle, and pigs from 670 acre project area	$290,000	$3,000	$3,000	$3,000	$3,000	$3,000	$27,000	$332,000	$3,000
Hire a full-time Natural Resources Manager	$55,000	$55,000	$55,000	$55,000	$55,000	$55,000	$495,000	$825,000	$55,000
-- Develop and implement a fire control plan for the project area	Assigned tasks of full-time Natural Resources Manager							$0	
-- Develop and implement a long-term monitoring plan								$0	
Supplemental budget for Conservation Stewardship Program implementation		$30,000	$30,000	$30,000	$30,000	$30,000	$67,500	$217,500	$7,500
Wildlife Education and Observation Program (WEOP)		$2,500	$2,500	$2,500	$2,500	$2,500	$22,500	$35,000	$2,500
On-Site Native Plant Preservation Area Subtotal	$ 795,000	$ 393,500	$ 93,500	$ 93,500	$ 93,500	$ 93,500	$ 639,000	$ 2,201,500	$ 71,000

KANAIO Off-Site Mitigation for Blackburn's Sphinx Moth	[1] Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Subsequent Years (9)	Permit Total	Annual Cost Year 16 Forward
Easement for 164 acres of Ulupalakua Ranch lands at Kanaio	***Confidential Terms and Conditions***								
Funding for supplemental fencing at mitigation site	$230,000	$100,000	$5,000	$5,000	$5,000	$5,000	$45,000	$395,000	$5,000
Funding for ungulate removal from mitigation site	$50,000	$25,000	$5,000	$5,000	$5,000	$5,000	$45,000	$140,000	$5,000
Cross fencing	$100,000	$0	$0	$0	$0	$0	$0	$100,000	
Fire break along fenceline	$32,400	$32,400	$5,000	$5,000	$5,000	$5,000	$45,000	$129,800	$5,000
Off-Site Blackburn's sphinx moth at Kanaio Subtotal	$ 412,400	$ 157,400	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 135,000	$ 764,800	$ 15,000

AUWAHI Off-Site Mitigation for Blackburn's Spinx Moth	[1] Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Subsequent Years (9)	Permit Total	Annual Cost Year 16 Forward
Easement for 190 acres of Ulupalakua Ranch lands at Auwahi	***Confidential Terms and Conditions***								
Fencing	$ 320,000	$ -						$ 320,000	
Ungulate removal from mitigation site	$ 30,000							$ 30,000	
Site Management	$ 100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$900,000	$1,500,000	$100,000
Off-site Blackburn's sphinx moth at Auwahi Subtotal	$ 450,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	$ 900,000	$ 1,850,000	$ 100,000

On-Site Mitigation for Hawaiian Goose	[1] Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Subsequent Years (9)	Permit Total	Annual Cost Year 16 Forward
Public education kiosks on golf course tees and clubhouse		$ 5,000	$ 500	$500	$500	$500	$4,500	$11,500	$500
Funding to conduct predator trapping and monitoring		$ 2,500	$2,500	$2,500	$2,500	$2,500	$22,500	$35,000	$2,500
On-Site Hawaiian Goose Subtotal	$ -	$ 7,500	$ 3,000	$ 3,000	$ 3,000	$ 3,000	$ 27,000	$ 46,500	$ 3,000
Off-Site Mitigation for Hawaiian Goose	**[1] Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Subsequent Years (9)**	**Permit Total**	**Annual Cost Year 16 Forward**
Operational costs Hawaii Wildlife Center		$ -	$ 5,000	$5,000	$5,000	$5,000	$10,000	$30,000	$0
Per Bird Cost		$ -	$ 3,000	$3,000	$3,000	$3,000	$6,000	$18,000	$0
Off-site Hawaiian Goose Subtotal	$ -	$ -	$ 8,000	$ 8,000	$ 8,000	$ 8,000	$ 16,000	$ 48,000	$ -

On-site Monitoring	[1] Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Subsequent Years (9)	Permit Total	Annual Cost Year 16 Forward
Funding for monitoring, including independent verification (DOFAW)	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$67,500	$112,500	$0
Off-site Monitoring	**[1] Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Subsequent Years (9)**	**Permit Total**	**Annual Cost Year 16 Forward**
Funding for monitoring, including independent verification (DOFAW)	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$67,500	$112,500	$0

SUBTOTALS	[1] Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Subsequent Years (9)	Permit Total	Annual Cost Year 16 Forward
On-Site Mitigation Subtotals	$ 802,500	$ 408,500	$ 104,000	$ 104,000	$ 104,000	$ 104,000	$ 733,500	$ 2,360,500	$ 74,000
Off-site Mitigation Subtotals	$ 869,900	$ 264,900	$ 130,500	$ 130,500	$ 130,500	$ 130,500	$ 1,118,500	$ 2,775,300	$ 115,000
ANNUAL TOTALS	**$ 1,672,400**	**$ 673,400**	**$ 234,500**	**$ 234,500**	**$ 234,500**	**$ 234,500**	**$ 1,852,000**	**$ 5,135,800**	**$ 189,000**

[1] Timeline starts at the initiation of Project's Phase I construction.

[2] Easements will be established upon HCP approval. Funding assurances will be provided for Off-Site Mitigation Costs at start of Project's Phase I construction.

Appendix 9

Appendix 10

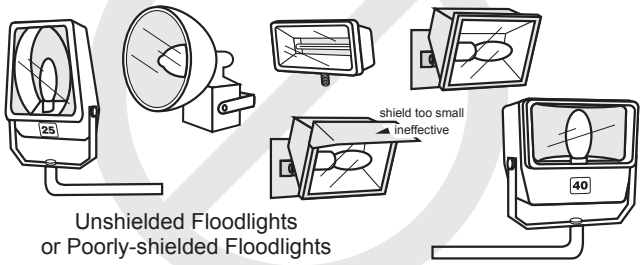
Appendix 10

SEABIRD FRIENDLY LIGHTING SOLUTIONS

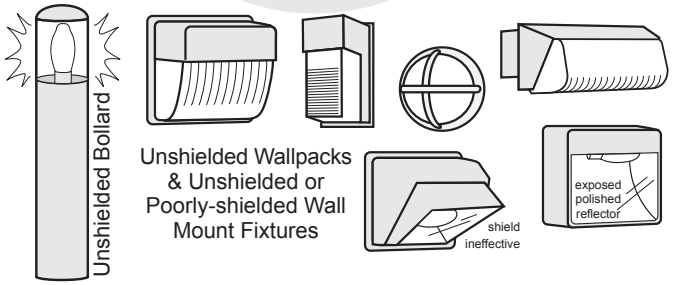
Help eliminate seabird light attraction. Select the best fixture for your application using this guide. Avoid uplighting, always shield floodlights, and aim downlights carefully to avoid light trespass. For more information go to www.kauai-seabirdhcp.info.

Unacceptable / Discouraged

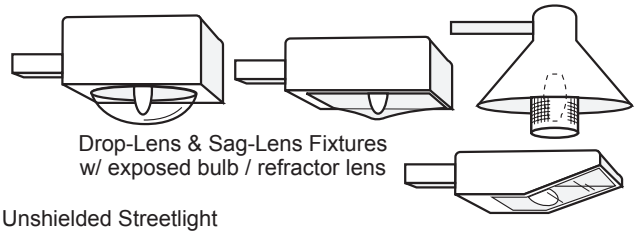
Fixtures that produce glare and light trespass



Unshielded Floodlights
or Poorly-shielded Floodlights

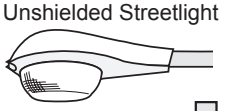


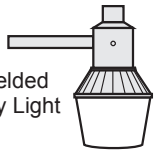
Unshielded Wallpacks
& Unshielded or
Poorly-shielded Wall
Mount Fixtures



Drop-Lens & Sag-Lens Fixtures
w/ exposed bulb / refractor lens

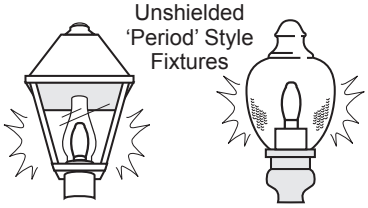
Unshielded Streetlight



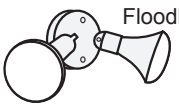


Unshielded
Security Light

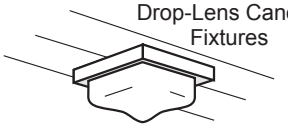
Unshielded
'Period' Style
Fixtures



Unshielded PAR
Floodlights

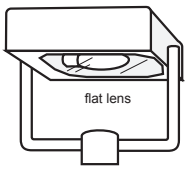


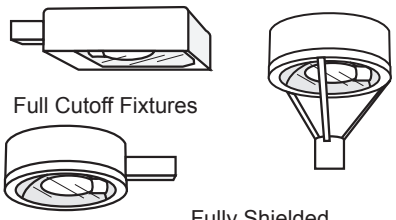
Drop-Lens Canopy
Fixtures



Acceptable

Fixtures that shield the light source to minimize glare and light trespass and to facilitate better vision at night

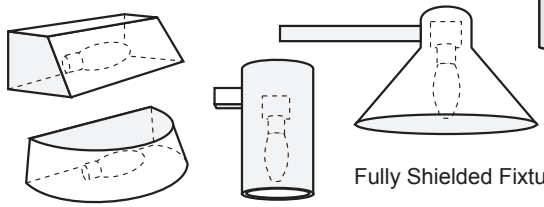




Full Cutoff Fixtures

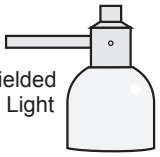
Fully Shielded
Wallpack & Wall
Mount Fixtures

Fully Shielded
Walkway
Bollards



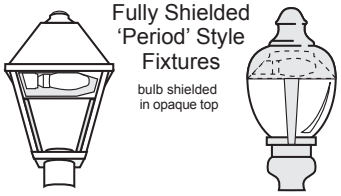
Fully Shielded Fixtures

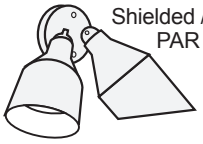
Full Cutoff Streetlight



Fully Shielded
Security Light

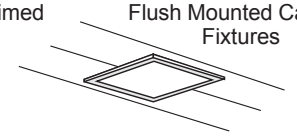
Fully Shielded
'Period' Style
Fixtures
bulb shielded
in opaque top



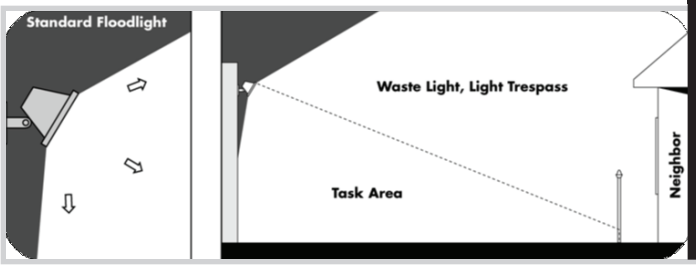


Shielded / Properly-aimed
PAR Floodlights

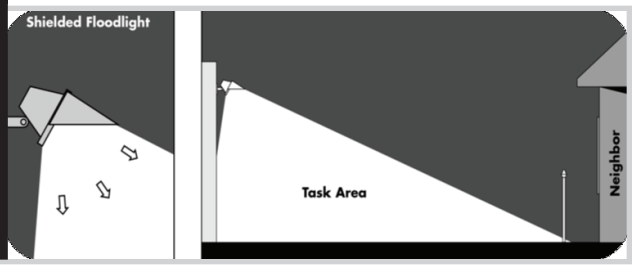
Flush Mounted Canopy
Fixtures



Unshielded floodlight that is angled incorrectly



Shielded floodlight that is angled correctly



Illustrations from
www.darksky.org and
www.darkskysociety.org

Appendix 10

Appendix 11

2010
Honua'ula (Wailea 670)

Within historic range, located amid three BSM Critical Habitat Units (Puu O Kali, Cape Kinau, Kanaio and near largest known BSM population.

1. Examine all tree tobacco plants for BSM activity.

2. If the plant is entirely herbaceous and there are no eggs, larvae, or signs indicating BSM pupae may be present, the plant and its root ball may be removed.

3. If BSM eggs, larvae, or signs are present, wait until plants are free of BSM eggs and larvae and then follow the steps outlined below.

4. If the plant is woody and there are no BSM eggs, larvae, or signs, the above-ground portion of the plant may be cut off and removed.

5. If the plant is woody, it is possible that signs of BSM foraging have been shed and that root disturbance could dislodge pupae; therefore, soil and plant roots must be left undisturbed for a period of one year. A 10-meter disturbance-free buffer must be established around the woody host plant to prevent disturbance of any pupating larvae in the ground around the plant.

6. Maintain cut stems free of growth by painting with herbicide or frequent hand clipping to prevent future use by BSM.

7. After one year, roots may be removed.

8. Repeat surveys and removal of BSM-free plants until all plants are removed.