
APPENDIX C:

Terrestrial Flora and Fauna Technical
Report for the Proposed East Maui Water
Lease

SWCA Environmental Consultants



Terrestrial Flora and Fauna Technical Report for the Proposed East Maui Water Lease

APRIL 2019

PREPARED FOR

Wilson Okamoto Corporation

PREPARED BY

SWCA Environmental Consultants

TERRESTRIAL FLORA AND FAUNA TECHNICAL REPORT FOR THE PROPOSED EAST MAUI WATER LEASE

Prepared for

Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawai'i 96826

Prepared by

SWCA Environmental Consultants
307a Kamani Street
Honolulu, Hawai'i 96813
(808) 548-7899
www.swca.com

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EXECUTIVE SUMMARY

In May 2001, Alexander & Baldwin, Inc. (A&B) and its subsidiary, East Maui Irrigation Company, Limited (EMI) (also collectively referred to as A&B), filed an application for the Sale of Lease (Water License) at Public Auction (Water Lease Application) with the Board of Land and Natural Resources (BLNR) seeking a long-term (30-year) lease for the right, privilege, and authority to enter and go upon the License Area (Figure A-1, Appendix A) for the purpose of developing, diverting, transporting, and using government-owned water (Water Lease). The long-term lease has yet to be awarded due to court challenges and petitions.

An environmental impact statement (EIS) is being prepared by Wilson Okamoto Corporation (WOC) in support of the Water Lease Application. SWCA Environmental Consultants (SWCA) was contracted by WOC to assess terrestrial flora and fauna resources, including the potential for presence of state or federally listed threatened, endangered, proposed, or candidate species or rare species (hereafter referred to as special-status species). For well over a hundred years, the EMI Aqueduct System has diverted water collected within an approximately 50,000-acre area (Collection Area) that is comprised of the License Area, and approximately 17,000 acres of privately owned land.

The Proposed Action constitutes the issuance of a long-term Water Lease for the continued “right, privilege, and authority to enter and go upon” the License Area for the “purpose of developing, diverting, transporting, and using government owned waters” through the existing EMI Aqueduct System to deliver water to the County Of Maui Department of Water Supply (MDWS) for domestic and agricultural water needs in Upcountry Maui, including agricultural users at the Kula Agricultural Park (KAP) and the 262-acre KAP expansion, as well as a portion of the Nāhiku community. It will also allow for the continued provision of water to approximately 30,000 acres of agricultural lands (formerly in sugarcane) in Central Maui.

The maximum amount of water that can be awarded through the Water Lease will be determined by a recent related, but independent, action taken by the Commission on Water Resource Management (CWRM). On June 20, 2018, CWRM issued a decision and order setting Interim Instream Flow Standards (IIFS) for many of the stream within the License Area. The CWRM decision ordered full stream restoration for 10 streams¹ and some flow restoration on additional streams. Compliance with the CWRM decision is required independent of the Water Lease Application.

The assessment of flora and fauna resources includes the License Area in East Maui and the former sugarcane fields of Central Maui (collectively, the Study Area). The assessment of the License Area considers the amount of water restored to streams by the IIFS. The assessment of the former sugarcane fields in Central Maui pertains to the impacts of using the water made available through the Water Lease for diversified agriculture relative to the former sugarcane monocrop and the current mostly unirrigated fallow condition. The areas in Upcountry Maui and Nāhiku served by the MDWS using water obtained through the EMI Aqueduct System are not assessed in this report. These areas are highly altered urban and agricultural environments maintained by imported water. The Proposed Action is not anticipated to significantly reduce the amount of water currently available for these areas, although future growth may be limited. Under a more restricted availability of water, new sources of water may need to be developed. If not, the frequency and duration of historic restrictions on water usage during drought conditions may increase. Such changes are not anticipated to affect terrestrial flora and fauna resources.

¹ Puolua (also known as Huelo) Stream, is a tributary to Hanehoi Stream, and per the June 20, 2018, CWRM IIFS Decision and Order, was ordered to be fully restored and is included in the count of “fully restored streams.”

The flora and fauna surveys were conducted by the SWCA botanist and wildlife biologist from November 28, 2017, to December 1 (ground surveys), 2017, and on January 5, 2018 (aerial surveys). Ground (automotive and pedestrian) and aerial (helicopter) surveys were conducted to determine whether vegetation types and species found during previous surveys and mapping efforts are still present in the Study Area and to record any notable changes. Fauna surveys consisted of both ground and aerial surveys and consisted of visual observations (aided by 10 × 42–millimeter (mm) binoculars) and auditory vocalization identifications. All birds, mammals, reptiles, amphibians, fish, and invertebrate species seen or heard and any sign (scat or tracks) were noted. The survey focused on approximately 33,000 acres of East Maui (License Area) and approximately 30,000 acres of Central Maui (Service Area). Collectively, the License and Service Areas make up the Study Area for this study.

Both ground and aerial flora surveys determined that the Hawai‘i Gap Analysis Program vegetation data layer produced by Gon et al. (2006) was highly representative of the vegetation found in the Study Area. The License Area comprises primarily open and closed ‘ōhi‘a (*Metrosideros polymorpha*) forest, and the Service Area comprises primarily agriculture. No special-status plant species were found during ground surveys of the License Area or Service Area. However, critical habitat for 18 special-status species is located in the License Area *mauka* (upslope) of the EMI Aqueduct System, and portions of the EMI Aqueduct System transect wet cliffs and other suitable habitat for these species. For this reason, a biological monitor is recommended to be on-site when maintenance activities are conducted in areas where special-status species are likely to be encountered.

Three endemic (native) avifauna—‘apapane (*Himatione sanguinea*), Hawai‘i ‘amakihi (*Chlorodrepanis virens wilsoni*), and ‘i‘iwi (*Drepanis coccinea*)—were found during ground surveys of the License Area in East Maui, one of which, the ‘i‘iwi, is federally listed as threatened. Ground surveys of the Service Area found 13 bird species that are protected by the Migratory Bird Treaty Act, three of which are federally and state listed. In addition to species seen during the surveys, 12 special-status species could occur in the Study Area: crested honeycreeper (*Palmeria dolei*), Maui parrotbill (*Pseudonestor xanthophrys*), Hawaiian duck (*Anas wyvilliana*), Hawaiian goose (*Branta sandvicensis*), Hawaiian petrel (*Pterodroma sandwichensis*), Newell’s shearwater (*Puffinus auricularis newelli*), band-rumped storm-petrel (*Oceanodroma castro*), Hawaiian hoary bat (*Lasiurus cinereus semotus*), Blackburn’s sphinx moth (*Manduca blackburni*), flying earwig Hawaiian damselfly (*Megalagrion nesiotes*), Pacific Hawaiian damselfly (*Megalagrion pacificum*), and orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*). Recommendations to avoid and minimize impacts to these species are provided in this report.

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1 INTRODUCTION

In May 2001, Alexander & Baldwin, Inc. (A&B) and its subsidiary, East Maui Irrigation Company, Limited (EMI) (also collectively referred to as A&B), filed an application for the Sale of Lease (Water License) at Public Auction (Water Lease Application) with the Board of Land and Natural Resources (BLNR) seeking a long-term (30-year) lease for the right, privilege, and authority to enter and go upon the License Area (Figure A-1, Appendix A) for the purpose of developing, diverting, transporting, and using government-owned water (Water Lease). The long-term lease has yet to be awarded due to court challenges and petitions. However, for well over a hundred years, the EMI Aqueduct System has diverted water collected within an approximately 50,000-acre area (Collection Area) of which approximately 33,000 acres are owned by the State of Hawai'i (License Area) and approximately 17,000 acres are privately owned.

An environmental impact statement (EIS) is being prepared by Wilson Okamoto Corporation (WOC) in support of the Water Lease Application. SWCA Environmental Consultants (SWCA) was contracted by Wilson Okamoto Corporation to assess terrestrial flora and fauna resources, including the potential for the presence of state or federally listed threatened, endangered, proposed, or candidate species or rare species (hereafter referred to as special-status species). In general, this focuses on approximately 33,000 acres in East Maui (License Area), and approximately 36,000 acres² of former sugar fields in Central Maui (Service Area), which are collectively referred to as the Study Area (see Figure A-1, Appendix A). This report details the field methods, results, impacts analysis, and suggested avoidance and minimization measures for the project.

1.1 Proposed Action

The Proposed Action constitutes the issuance of a long-term Water Lease for the continued right, privilege, and authority to enter and go upon the License Area for the purpose of developing, diverting, transporting, and using government owned water through the existing EMI Aqueduct System to deliver water to Upcountry Maui, including agricultural users at the Kula Agricultural Park (KAP) and the 262-acre KAP expansion, as well as the Nāhiku community. It will also allow for the continued provision of water to approximately 30,000 acres of agricultural lands (formerly in sugarcane) in Central Maui within the approximately 36,000-acre Service Area.

The maximum amount of water that can be awarded through the Water Lease will be determined by a recent related, but independent, action taken by the Commission of Water Resource Management (CWRM). On June 20, 2018, the CWRM issued a decision and order setting the Interim Instream Flow Standards (IIFS) for many of the streams in the License Area. The CWRM decision ordered full stream restoration for 10 streams and some flow restoration on additional streams. Compliance with the CWRM decision is required independent of the Water Lease Application.

The assessment of flora and fauna resources includes the Study Area. The assessment of the License Area considers the amount of water restored to streams by the IIFS. The assessment of the former sugarcane fields in Central Maui pertains to the impacts of using the water made available through the Water Lease for diversified agriculture relative to the former sugarcane monocrop and the current mostly unirrigated fallow condition. The areas in Upcountry Maui and Nāhiku served by the MDWS using water obtained through the EMI Aqueduct System are not assessed in this report. These areas are highly altered urban and agricultural environments maintained by imported water. The Proposed Action is not anticipated to significantly reduce the amount of water currently available for these areas, although future growth may

² There is approximately 30,000 acres of agricultural land in the Service Area. The remaining approximately 6,000 acres includes roads, gulches, and patches of uncultivated land, as described in Table 3.

be limited. Under a more restricted availability of water, new sources of water may need to be developed. If not, the frequency and duration of historic restrictions on water usage during drought conditions may increase. Such changes are not anticipated to affect terrestrial flora and fauna resources.

The License Area encompasses approximately 33,000 acres of State Forest Reserve on the north slope of Haleakalā. The License Area lies *mauka* (upslope) of Hāna Highway (Route 36) and is the only major thoroughfare that extends through East Maui. Most of the mauka boundary of the Nāhiku watershed adjoins more state land. A small portion of it and a small portion of the Ke‘anae watershed abuts federal land comprising the Haleakalā National Park. The mauka boundaries of the Huelo, Honomanū, and most of the Ke‘anae watersheds are bordered by privately owned land.

The purpose of the Water Lease is to allow the lessee the ability to continue to go on lands owned by the state to maintain and repair existing access roads and trails used as part of the EMI Aqueduct System and would allow continued operation of the EMI Aqueduct System to deliver water to the Maui County Department of Water Supply (MDWS) for domestic and agricultural water needs in Upcountry Maui; for the Nāhiku community, which draws on average 41,000 gallons per day directly from the EMI Aqueduct System; and for agricultural users at the KAP and a proposed future 262-acre expansion of KAP. It would also allow the continued provision of water to approximately 30,000 acres of agricultural lands (formerly in sugarcane) in Central Maui included within the approximately 36,000-acre Service Area. The area to which water would be delivered is referred to as the Service Area (see Figure A-1, Appendix A).

The proposed Water Lease will ensure that the EMI Aqueduct System, which enabled the cultivation of naturally non-arable lands in Central Maui, will continue to serve the community and Maui’s rich agricultural heritage and will enhance the sustainability and diversity of Maui’s economy. Although sugarcane activities were terminated in 2016, A&B has stated that its goal is to put as much of that former sugarcane land into diversified agricultural uses as is economically feasible. On December 20, 2018, A&B sold approximately 40,000 acres, including these Central Maui agricultural fields (i.e., the Service Area), to Mahi Pono, LLC (Mahi Pono). Mahi Pono has stated that it intends to cultivate a variety of crops within the Service Area. Mahi Pono is presently a partner in the ownership and management of the EMI Aqueduct System. The utilization of waters from the EMI Aqueduct System will be an essential element to the success of any diversified agricultural pursuits.

The EMI Aqueduct System continues to serve a critical role in providing Upcountry Maui and the Nāhiku community with the ability to meet domestic and agricultural water demands, and should the delivery of water from the EMI Aqueduct System be curtailed, Upcountry Maui and the Nāhiku community would be left without a reliable source of water. The Water Lease is not expected to allow more water than the amount available for diversion after the CWRM IIFS (IIFS) Decision and Order (D&O) (CWRM 2018). The Draft EIS will address the anticipated timing of the Proposed Action.

In general, the objectives of the issuance of the proposed water lease (Proposed Action) are to

- preserve and maintain the EMI Aqueduct System,
- continue to meet domestic and agricultural water demands in Upcountry Maui,
- continue to provide water for agricultural purposes in Central Maui, and
- continue to serve community water demands in Nāhiku.

The EMI Aqueduct System encompasses approximately 388 separate intakes, over 24 miles of ditches, and 50 miles of tunnels, as well as numerous small dams, intakes, pipes, siphons, and flumes. The EMI Aqueduct System is composed of four major ditches: the Wailoa Ditch, New Hamakua Ditch, Lowrie Ditch, and Haiku Ditch. The Wailoa Ditch starts at Makapipi Stream at approximately 1,350 feet and ends at Kamole Weir at approximately 1,150 feet. The New Hamakua Ditch starts at Alo Stream at

approximately 1,260 feet and ends at Kauhikoa Maliko at approximately 900 feet. The Lowrie Ditch starts at Nailiilihaele Stream at approximately 660 feet and ends at Lowrie at Maliko at approximately 540 feet. Haiku Ditch starts at Kailua Stream at approximately 480 feet and ends at Haiku Maliko at approximately 320 feet. There are 36 identified streams by CWRM within the License Area; the EMI Aqueduct System historically diverted surface water from 34 of these streams³.

1.2 No Action Alternative

Under this alternative, the right, privilege, and authority to enter and go upon the License Area for the purpose of developing, diverting, transporting, and using government-owned waters would not be offered for sale as a lease at public auction by the state. Consequently, no entity (including A&B) would have the right to use waters derived from state lands. As a consequence of this alternative, both domestic and agricultural water demands in Upcountry Maui, as well as the community of Nāhiku, and agricultural demands in Central Maui would need to be met by alternative water sources that may include but are not limited to desalinization of seawater or brackish groundwater or the extraction of fresh groundwater from wells that currently do not exist. Another option may be to continue obtaining non-government-owned waters from the EMI Aqueduct System's Collection Area, as well as from privately owned lands outside of the License Area through the EMI Aqueduct System, if continued maintenance of the system for that purpose is economically feasible. It is unknown whether sufficient groundwater resources exist in either Central or Upcountry Maui that could meet these water demands. It is anticipated that the development of alternative water source infrastructure would be prohibitively expensive, and, depending upon the specific sources or a combination of sources, could result in significant direct adverse impacts to the environment. While water demands in Central and Upcountry Maui could be potentially minimized through the implementation of water conservation measures, the extent to which such efforts would serve to counter reduced levels of water service is uncertain.

1.3 Water Lease Volume Alternative

The Water Lease Volume alternative is understood as a modification (reduction) to the volume of water that is diverted from East Maui streams that would be available for diversion after the compliance with the CWRM IIFS D&O. As a consequence of this alternative, the overall amount of water that could be diverted to meet domestic and agricultural water demands in Upcountry Maui, as well as the community of Nāhiku, and agricultural demands in Central Maui would be reduced.

1.4 Water Lease Term Alternative

The Water Lease Term Alternative is understood as a modification to the term for which the Water Lease will be awarded for other than the proposed term of 30 years. As a consequence of this alternative, should the lease term be shorter, diversified agriculture may not be able to come to fruition in Central Maui (i.e., the Service Area).

1.5 Management Alternative

The Management Alternative is understood as a change of the entity that manages the diversion of water from East Maui streams. Currently, the EMI Aqueduct System is managed by EMI, which is jointly owned by A&B and Mahi Pono. As a consequence of this alternative, the EMI Aqueduct System would in turn be managed by another entity other than the current operators.

³ The Draft Environmental Impact Statement identifies 37 streams within the License Area; Puakea Stream was not recognized by CWRM but is a stream within the License Area that is diverted by the EMI Aqueduct System.

1.6 Greater Public Access Alternative

The Greater Public Access Alternative is understood as the License Area being reduced in size to only cover the area where the EMI Aqueduct System and existing access roads (presumably with an additional buffer area) exist, allowing more public access into the area from current levels. As a result, public access would increase in the current License Area.

2 REGULATORY ENVIRONMENT

This section describes laws and regulations applicable to terrestrial flora and fauna in the context of the project.

2.1 Endangered Species Act

The federal Endangered Species Act (ESA) of 1973, as amended, protects wildlife and plant species that have been listed as threatened or endangered. It is designed to conserve the ecosystem on which species depend. Candidate species, which may be listed in the near future, are not afforded protection under the ESA until they are formally listed as endangered or threatened. Section 9 of the ESA and rules promulgated under Section 4(d) of the ESA prohibit the unauthorized take of any endangered or threatened species of 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.” As defined in regulations, the term *harm* means “an act that actually kills or injures wildlife; it may include significant habitat modification or degradation, which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering” (50 Code of Federal Regulations [CFR] 17.3). The rules define *harass* to mean “an intentional or negligent act or omission that 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 ESA affords maximum legal protections to wildlife species listed as threatened or endangered under the law and also provides authorization for incidental take permits (ITP) for take that occurs incidental to otherwise legal operations. To comply with federal laws, additional measures must be taken to ensure that take of ESA-listed wildlife species does not occur. Any fatality of a listed wildlife species should be reported to the U.S. Fish and Wildlife Service (USFWS) and the Hawai‘i Division of Forestry and Wildlife (DOFAW) as soon as possible, and an incident report should be filed within 24 hours of detection. It is not prohibited by the ESA to destroy, damage or move listed plants unless such activities involve an ESA-listed plant species on federal land or if the action occurs in violation of state laws. If private land is developed, with no federal jurisdiction involved, and in accordance with state law, then the potential destruction, damage, or movement of ESA-listed plants does not violate the ESA. Although there is an ITP process for wildlife in section 10 (a)(1)(B) of the ESA, there is no such process for plants.

2.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) of 1918, as amended, prohibits the take of migratory birds. A list of birds protected under MBTA-implementing regulations is published under 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 sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product” (16 United States Code 703–712). The MBTA provides no process for authorizing incidental take of MBTA-protected

birds. As a result, birds that are not covered under the ESA that may be adversely affected by the proposed project cannot be covered by take authorizations. Furthermore, a recent memorandum from the Department of the Interior (M-37050, December 22, 2017) concludes that the MBTA does not prohibit the incidental taking of migratory birds. Regardless, incidental take of individual MBTA-protected species is unlikely to adversely affect the species as a whole; however, any take of MBTA-protected species should be documented and reported in a similar manner to any endangered or threatened species of wildlife listed under the ESA.

2.3 Hawai‘i Revised Statutes Chapter 195D

The purpose of Hawai‘i Revised Statutes (HRS) Chapter 195D is “to insure the continued perpetuation of indigenous aquatic life, wildlife, and land plants, and their habitats for human enjoyment, for scientific purposes, and as members of ecosystems.” Section 195D-4 states that any endangered or threatened species of fish or wildlife recognized by the ESA shall be so deemed by the state statute. Like the ESA, the unauthorized take of such endangered or threatened species is prohibited (HRS 195-D-4[e]), but incidental take licenses can be obtained (HRS Section 195D-21). In addition to species protected under the ESA, rules adopted under HRS Section 195D-4 allow for the listing of indigenous species as threatened or endangered due to the following reasons:

- Habitat destruction or alteration (current or predicted)
- Overexploitation
- Disease or predation
- Lack of regulatory mechanisms
- Other factors threatening the species’ continued existence

Determinations are made based on any and all available sources of data (scientific, commercial, and other) and consultation with appropriate agencies (federal, state, and county) and interested organizations and parties.

3 LITERATURE REVIEW

SWCA conducted a literature review of published articles, government reports, and scholarly reports in preparation for field surveys. Table 1 lists the reports reviewed and pertinent items gleaned from each report.

Table 1. East Maui Flora and Fauna Literature Review

Document	Relevance
<i>Hanawi Natural Area Reserve Management Plan</i> (DLNR 1989)	Describes the general setting, flora, and fauna of a 7,500-acre parcel that occurs within the License Area.
<i>Waikamoi Preserve East Maui Irrigation (EMI) Addition: Long Range Management Plan</i> (The Nature Conservancy, Maui Program 2014)	Describes the flora, fauna, and rare species present in a 3,721-acre parcel adjacent to the License Area.
<i>Vegetation Maps of the Upland Plant Communities on the Islands of Hawai‘i, Maui, Moloka‘i, and Lana‘i</i> (Jacobi 1989)	Summarizes the results of a large-scale vegetation mapping project on the islands of Hawai‘i, Maui, Moloka‘i, and Lana‘i that was developed to determine the current status of native forest birds and their associated habitats.

Document	Relevance
<i>Mapping Plant Species Ranges in the Hawaiian Islands: Developing a Methodology and Associated GIS Layers</i> (Price et al. 2007)	Documents the methods used to map the geographic ranges of plant species in upland areas of the Hawaiian Islands using a geographic information system (GIS) and details several practical uses for species range maps.
<i>Final Environmental Assessment for Hana Highway Storm Damage Repairs Huelo Towards Nahiku</i> (State of Hawaii, Department of Transportation, Highways Division 1993)	Describes repairs to the Hāna Highway that encroached on a Special Management Area within the License Area.
<i>Multi-Scale Analysis of Keanae Valley-Koolau Gap</i> (Myers 1998b)	Evaluates the use of satellite remote sensing, aircraft-based remote sensing, aerial photography, and ground-based survey data for monitoring native and alien vegetation species in East Maui.
<i>Land Use and Vegetation Change in the Windward East Maui Watershed</i> (Myers 1998a)	Describes a study that tracked individual trees or stands of vegetation in windward East Maui over the course of 50 years, which provides a summary of the dynamic vegetation changes in this area over time.
<i>Draft Revised Recovery Plan for Hawaiian Forest Birds</i> (USFWS 2003a)	Describes federally listed forest bird fauna in the License Area.
<i>Recovery Plan for Hawaiian Waterbirds</i> (USFWS 2011)	Describes federally listed waterbird locations on Maui.
<i>Conservation Biology of Hawaiian Forest Birds</i> (Pratt et al. 2009)	Describes habitat and life history requirements for Hawaiian forest birds.
<i>Assessment of the Environmental Impact of Stream Diversions on 21 East Maui Streams using the Hawaiian Stream Habitat Evaluation Procedure (HSHEP) Model</i> (Trutta 2019)	A project-specific survey that combines the results of habitat and diversion assessments and biotic surveys with the HSHEP model to assess issues associated with the current stream diversions and potential impacts to optimizing water withdrawal, including loss of instream habitat from construction or diversion of streamflow, creation of barriers to stream animal upstream movement, and entrainment of downstream drifting larvae.

4 FIELD METHODS

4.1 Flora

Flora surveys consisted of a combination of ground (automotive and pedestrian) and aerial (helicopter) surveys of the Study Area. Ground surveys took place from November 28, 2017, to December 1, 2017, to determine whether vegetation types and species found during previous surveys and mapping efforts are still present in the Study Area and to record any notable changes. Rocky outcrops, gulches, waterfalls, cliffsides, and other areas likely to contain native species were closely examined.

Plants recorded during the survey are indicative of the season (rainy versus dry) and the environmental conditions at the time of the survey. It is likely that additional surveys conducted at a different time of the year would result in minor variations in the species and abundances of plants observed.

An analysis was performed in ArcMap to link special-status plants to the Hawai'i Gap Analysis Program (HIGAP) vegetation classes where they are most likely to occur. This was done by intersecting the USFWS Critical Plant habitat shapefile with the HIGAP raster to calculate which HIGAP vegetation classes were found within each critical habitat polygon.

4.1.1 ***Vegetation Map Verification: Aerial Survey***

The HIGAP data layer (Gon et al. 2006) was determined to be the most representative of the Study Area. To verify the HIGAP vegetation layer across the Study Area, SWCA conducted an aerial (helicopter)

survey on January 5, 2018. Meandering transects were flown throughout the Study Area with the purpose of matching HIGAP polygons with observed vegetation. All data was mapped and analyzed using ArcGIS 10.5 software. The following equipment was used:

- A Trimble Geo Explorer XT 6000 Series global positioning system (GPS) collected point data using ArcPad software from Esri and tracked log data for ground surveys.
- A Samsung Tablet collected GPS data during the helicopter survey with Collector for ArcGIS software.
- A Garmin Aera 500 Series portable aviation GPS assisted in programming a flight plan for the pilot and collecting flight path track data for post-survey analysis using Garmin BaseCamp software.
- iPhone movies and photographs were taken during the helicopter survey.
- A Canon PowerShot SX530 HS was used to collect photographs during the helicopter survey.

4.2 Fauna

Fauna surveys consisted of a combination of ground (automotive and pedestrian) and aerial (helicopter) surveys of the Study Area. Ground surveys were conducted from November 28, 2017, to December 1, 2017, and consisted of visual observations (aided by 10 × 42–millimeter binoculars) and auditory vocalization identifications. All birds, mammals, reptiles, amphibians, fish, and invertebrate species seen or heard and any sign (scat or tracks) were noted. Field surveys for the endangered Hawaiian hoary bat, or ‘ope‘ape‘a (*Lasiurus cinereus semotus*), were conducted by noting areas of suitable foraging and roosting habitat as indicators of potential presence; acoustic surveys were not conducted. An aerial survey took place on January 5, 2018, from 10:00 a.m. to 2:00 p.m. to evaluate potential habitat types for federal- and state-listed species.

5 RESULTS

The following section describes the results of the flora and fauna ground and aerial surveys in the Study Area. The Study Area includes the License Area in East Maui as well as the Service Area encompassing approximately 33,000 acres of former sugar land in Central Maui. As discussed previously, the areas served by the MDWS in Upcountry Maui, Nāhiku, and the KAP are excluded.

5.1 Flora

5.1.1 ***Vegetation Map Verification: Aerial Survey***

Following the aerial survey, the HIGAP vegetation data layer (Gon et al. 2006) was determined to be highly representative of the Study Area. The HIGAP vegetation layer describes 19 vegetation cover types in the License Area and 20 in the Service Area (Figures A-2 and A-3, Appendix A). Each vegetation cover type and the area of each is described in detail in Table B-1 in Appendix B. Tables 2 and 3 below list the area of each vegetation cover type present in the License and Service Areas, respectively. The License Area is composed primarily of open and closed ‘ōhi‘a forest. The Service Area comprises primarily agriculture.

Table 2. Area of Vegetation Cover Types Present in the License Area

Vegetation Cover Type	Area (acres)	% of Total
Open 'Ōhi'a Forest (uluhe)	10,934	33%
Closed 'Ōhi'a Forest (native shrubs)	8,575	26%
Alien Forest	7,658	23%
Closed 'Ōhi'a Forest (uluhe)	1,527	5%
Uncharacterized Open-Sparse Vegetation	1,430	4%
Uluhe Shrubland	658	2%
Closed Koa-'Ōhi'a Forest (uluhe)	611	2%
Uncharacterized Shrubland	579	2%
Alien Grassland	209	1%
Uncharacterized Forest	172	1%
Native Wet Cliff Vegetation	145	< 1%
Closed Koa-'Ōhi'a Forest (native shrubs)	139	< 1%
Native Shrubland/Sparse 'Ōhi'a (native shrubs)	82	< 1%
Deschampsia Grassland	22	< 1%
Native Shrubland (alien grasses)	22	< 1%
Open 'Ōhi'a Forest (native shrubs)	10	< 1%
Very Sparse Vegetation to Unvegetated	8	< 1%
Kikuyu Grass Grassland/Pasture	2	< 1%
Low Intensity Developed	1	< 1%
Total	32,784	100%

Table 3. Area of Vegetation Cover Types Present in the Service Area

Vegetation Cover Type	Area (acres)	% of Total
Agriculture	30,538	83%
Alien Forest	3,192	9%
Alien Grassland	1,247	3%
Open Kiawe Forest and Shrubland (alien grasses)	476	1%
Water	358	1%
Low Intensity Developed	313	1%
Uncharacterized Open-Sparse Vegetation	275	1%
Closed Kiawe - Koa Haole Forest and Shrubland	173	< 1%
Alien Shrubs and Grasses	57	< 1%
Very Sparse Vegetation to Unvegetated	34	< 1%
Kikuyu Grass Grassland / Pasture	31	< 1%
High Intensity Developed	25	< 1%
Closed 'Ōhi'a Forest (native shrubs)	24	< 1%
Alien Shrubland	17	< 1%
Open 'Ōhi'a Forest (uluhe)	16	< 1%

Vegetation Cover Type	Area (acres)	% of Total
Deschampsia Grassland	14	< 1%
Undefined	9	< 1%
Native Shrubland / Sparse Ōhi'a (native shrubs)	8	< 1%
Uncharacterized Forest	1	< 1%
Uncharacterized Shrubland	0	< 1%
Total	36,808	100%

5.1.2 Ground-Based Verification: License Area

Findings from the November 28, 2017, to December 1, 2017 flora (botanical) ground surveys of the License Area yielded results consistent with the vegetation types described in Gon et al. (2006) and with the description of plant communities cited in the Environmental Impact Statement Preparation Notice (EISPN) for the proposed Water Lease (EISPN 2017).

Ground surveys focused on access roads and aqueducts, which lie within the lower-elevation portions of the License Area. According to Gon et al. (2006), the vegetation within these lower-elevation areas consists largely of a heterogeneous mosaic dominated by Alien Forest vegetation, with occasional Open Ōhi'a Forest, Closed Ōhi'a Forest, and Uluhe Shrubland scattered throughout (see Figure A-2, Appendix A). The Native Wet Cliff Vegetation type was rarely encountered and was found at the upper elevational reaches of access roads. Lower portions of Pi'ina'au Road were described by Gon et al. as Uncharacterized Open-Sparse Vegetation, which was confirmed during ground surveys.

Descriptions of each vegetation type found during ground surveys of the License Area are below. This report uses the same terms for vegetation types used in Gon et al. (2006); however, the ground surveys demonstrated more complexity to the vegetation than can be seen from the air. For this reason, the vegetation types described below may not directly correspond with the descriptions given by the Gon et al. report.

5.1.2.1 ALIEN FOREST

Alien Forest was the most common vegetation type seen during ground surveys, and the HIGAP vegetation layer indicates that this vegetation type accounts for 23% of the vegetation in the License Area (see Table 2; Figure C-1, Appendix C). The description of this vegetation type in Gon et al. (2006) is as follows: "Mixed, typically dense canopies of alien tree species, often plantation forest plantings, with dominants including, but not limited to: *Eucalyptus*, *Casuarina*, *Falcataria*, *Araucaria*, *Fraxinus*, *Melaleuca*, *Psidium*, and *Grevillea* spp." Paperbark (*Melaleuca quinquenervia*) and eucalyptus (*Eucalyptus* spp.), likely introduced as forestry species, were found during the ground surveys to be the predominant overstory species in this vegetation type. Shoebutton ardisia (*Ardisia elliptica*) and strawberry guava (*Psidium cattleianum*) were common throughout the midstory, and understory species included a variety of non-native grass species such as basketgrass (*Oplismenus hirtellus* spp. *hirtellus*), Job's tears (*Coix lachryma-jobi*), and bristly foxtail (*Setaria verticillata*), in addition to herbaceous species such as Koster's curse (*Clidemia hirta*), Spanish needle (*Bidens pilosa*), and tick trefoil (*Desmodium triflorum*). 'Ie'ie (*Freycinetia arborea*), a native liana, and laua'e haole (*Phlebodium aureum*), a non-native epiphytic fern, can occasionally be seen twining through the midstory in this vegetation type.

5.1.2.2 OPEN/CLOSED ‘ŌHI‘A FOREST

Though less commonly seen during ground surveys, which focused on disturbed lowland areas dominated by non-native species, the Closed and Open ‘Ōhi‘a Forest vegetation type accounts for over 60% of the vegetation in the License Area (Figure C-2, Appendix C). Gon et al. (2006) describe this vegetation type as follows: “Vegetation dominated by an open or closed canopy of ‘Ōhi‘a (*Metrosideros polymorpha*) and other native trees, with an understory dominated by hāpu‘u tree ferns (*Cibotium* spp.), alien grasses, native shrubs, or uluhe (*Dicranopteris linearis* and/or other native mat ferns, e.g., *Sticherus*, *Diplopterygium*), typically at lowland-montane elevations in mesic-wet zones.” A strictly native species-dominated, closed-canopy overstory was rarely seen during ground surveys; instead, open ‘Ōhi‘a forests tended to have native species such as ‘Ōhi‘a, pāpala kēpau (*Pisonia grandis*), and lapalapa (*Cheirodendron trigynum*) co-dominating with invasive species such as African tulip tree (*Spathodea campanulata*) and Formosa koa (*Acacia confusa*). The midstory was often a co-dominant mixture of native and non-native as well, with natives such as hāpu‘u fern (*Cibotium* sp.) and koa (*Acacia koa*) blending with invasive species such as shoebutton ardisia, mule’s foot fern (*Angiopteris invecta*), and strawberry guava. The understory frequently consisted of uluhe with a mixture of non-native herbaceous species along the margins, including glorybush (*Tibouchina herbacea*), white ginger (*Hedychium coronarium*), Koster’s curse, Spanish needle, and Job’s tears.

5.1.2.3 ULUHE SHRUBLAND

Uluhe-dominated slopes were seen on ground surveys occurring adjacent to ‘Ōhi‘a forest on relatively steep slopes up and downhill from access roads (see Figure C-2, Appendix C). These areas were characterized by a generally monotypic understory layer of uluhe with the sporadic presence of native shrubs and trees, including ‘Ōhi‘a, pāpala kēpau, and lapalapa, but also the less commonly seen native species ‘ōhā wai nui (*Clermontia arborescens* spp. *waihia*).

5.1.2.4 NATIVE WET CLIFF VEGETATION

Wet cliff areas were thoroughly examined during ground surveys. Due to the steep aspect of these areas, they are less likely to be impacted by feral pigs or human activities and thus are more likely to contain threatened or endangered plant species. No threatened, endangered, or candidate plants were seen in these areas during the ground surveys, but some less-commonly seen species were noted, including a *Cyrtandra* species (likely *Cyrtandra grayi*), and ‘ōhā wai nui. Fern species tend to dominate these areas, most notably *Cyclosorus parasiticus*. *Machaerina*, a native sedge, was also frequently seen (Figure C-3, Appendix C).

5.1.2.5 UNCHARACTERIZED OPEN-SPARSE VEGETATION

Gon et al. (2006) describe this vegetation type as follows: “Open to sparse vegetation, occurring at all elevations, part of a complex mosaic of naturalized alien vegetation in a mosaic of forest, shrubland and grassland.” The lower portion of Pi‘ina‘au Road, a frequently used hunting access road, typifies this vegetation type. The understory (which exists in open areas and occasionally under tree and shrub layers) consists of a matrix of non-native herbs and grasses, including Job’s tears, Guinea grass (*Urochloa maxima*), *Cyclosorus parasiticus*, tick trefoil, sensitive plant (*Mimosa pudica* var. *unijuga*), and elephant's-foot (*Elephantopus mollis*). Shoebutton ardisia, hau (*Hibiscus tiliaceus*), and strawberry guava dominate the midstory, and the canopy consists primarily of eucalyptus and paperbark. The native species found in this vegetation type included māmakī (*Pipturus albidus*), hāpu‘u, and uluhe (Figure C-4, Appendix C).

5.1.3 Ground-Based Verification: Service Area

Findings from the December 1, 2017, flora (botanical) ground surveys of the Service Area yielded results consistent with the vegetation types described in Gon et al. (2006).

Surveys focused on the roads traversing the fallow sugarcane fields and the roads in housing areas adjacent to agricultural areas. According to the HIGAP vegetation layer, the vegetation located in the Study Area consists almost exclusively of the Agricultural vegetation type, with Alien Forest and Alien Grassland along the margins and Water features (with hydrophytic vegetation at their margins) spread throughout. Housing areas contain the High Intensity Developed vegetation type. Descriptions of each vegetation type found during ground surveys of the Service Area are below.

5.1.3.1 AGRICULTURE

According to the HIGAP vegetation layer, this vegetation type makes up 83% of the Service Area. The Agriculture vegetation type seen during ground surveys consisted almost entirely of fallow sugarcane (*Saccharum officinarum*) fields, some with sugarcane remaining and some where the sugarcane had been harvested. Corn (*Zea mays*) and Sunn hemp (*Crotalaria juncea*) were also being cultivated in some fields. Weedy plants seen within the fields included castor bean (*Ricinus communis*), Mexican poppy (*Argemone mexicana*), *Sida rhombifolia*, cheeseweed (*Malva parviflora*) and golden crown-beard (*Verbesina encelioides*). The non-native ruderal vines little bell (*Ipomoea triloba*), bitter melon (*Momordica charantia*), and *Macropodium atropurpureum* can be seen twining throughout (Figure C-5, Appendix C).

5.1.3.2 ALIEN GRASSLAND

Non-native grasses such as swollen fingergrass (*Chloris barbata*), Guinea grass, and pitted beardgrass (*Bothriochloa pertusa*) were found on the margins of most agricultural fields in the Service Area. Mixed in with these grasses was a variety of ruderal herbaceous species, similar to those found within the agricultural fields (Figure C-6, Appendix C).

5.1.3.3 ALIEN FOREST

Non-native species in this vegetation type found in the Service Area include *Pittosporum pentandrum*, Koa haole (*Leucaena leucocephala*), Christmas berry (*Schinus terebinthifolius*), and kiawe (*Prosopis pallida*). This suite of species can be found in the Service Area around abandoned buildings, on the margins of fallow fields, and occasionally along ditches and other water features (see Figure C-6, Appendix C).

5.1.3.4 WATER

Holding ponds and irrigation ditches are found sporadically throughout the agricultural portions of the Service Area and provide habitat for a number of non-native hydrophytic plant species, including sourbush (*Pluchea carolinensis*), primrose willow (*Ludwigia octovalvis*), and California grass (*Urochloa mutica*). Koa haole, *Pittosporum pentandrum*, Christmas berry, Java plum (*Syzygium cumini*), and common ironwood (*Casuarina equisetifolia*) can be found on uphill slopes near these water features, with maunaloa vine (*Canavalia cathartica*) occasionally twining in the under- and midstory (Figure C-7, Appendix C).

5.1.3.5 HIGH-INTENSITY DEVELOPED

Areas labeled High-Intensity Developed are described by Gon et al. as constructed areas and urban and rural housing. Plant species around these sites in the Service Area include commonly cultivated

ornamental and food plants such as ti (*Cordyline fruticosa*), mango (*Mangifera indica*), guava (*Psidium guajava*), hibiscus (*Hibiscus rosa-sinensis*), snowbush (*Breynia disticha*), mock orange (*Murraya paniculata*), panax (*Polyscias guilfoylei*), croton (*Codiaeum variegatum*), liliko‘i (*Passiflora edulis*), and plumeria (*Plumeria rubra*), as well as tolerated weeds, which include Chinese violet (*Asystasia gangetica*), yellow alder (*Turnera ulmifolia*), morning glory (*Ipomoea obscura*), and castor bean. Lawn grasses include St. Augustine grass (*Stenotaphrum secundatum*) and Bermuda grass (*Cynodon dactylon*) (Figure C-8, Appendix C).

5.1.4 Special-Status Flora and Critical Habitat

Special-status flora refers to plant species listed by the USFWS and the State of Hawai‘i as threatened, endangered, or candidate. These species are discussed in detail below.

The USFWS has identified 21 endangered or threatened plants with final designated critical habitat within or near the vicinity of the License Area (EISPN 2017: Appendix A). None of the species listed in the EISPN (2017) were found during ground or aerial surveys; however, it is very likely, given the size and range of vegetation cover types that occur in the License Area, that many of these species could or do exist in the area, particularly in higher elevations on steep cliffs and gulches inaccessible to grazing ungulates. Table 4 lists the 18 species with designated critical habitat that fall within the License Area and indicates which vegetation classes (taken from the HIGAP vegetation layer) are found within each critical habitat unit. See Figure A-4 in Appendix A for the locations of the critical habitat units. Some HIGAP vegetation classes found within the License Area shown in Figure A-2 in Appendix A were not listed as critical habitat for the 21 species identified by the USFWS in Appendix A of the EISPN, so they are not listed in Table 4. Three of the 21 species identified by the USFWS—*Peucedanum sandwicense*, *Ischaemum byrone*, and *Cyperus pennatifolius*—are coastal species whose designated critical habitat units are located outside of the License Area. No further analysis was performed for these species. Locations of voucher specimens for some species are shown in Table D-1, Appendix D.

Table 4. Endangered or Threatened Plant Species with Critical Habitat within the License Area

HIGAP Vegetation Classes Found in Critical Habitat Unit	Species found in Critical Habitat Unit (Hawaiian Name, Status)
Lowland Wet 01	
Alien Forest	<i>Bidens campylotheca</i> spp. <i>waihoiensis</i> (ko‘oko‘olau, ko‘olau, Endangered); <i>Clermontia samuelii</i> (‘ōhā wai, ‘ōhā, hāhā, Endangered); <i>Cyanea asplenifolia</i> , <i>Cyanea copelandii</i> spp.
Alien Grassland	<i>haleakalaensis</i> , <i>Cyanea hamatiflora</i> spp. <i>hamatiflora</i> , <i>Cyanea kunthiana</i> , <i>Cyanea maritae</i> , <i>Cyanea mceldowneyi</i> (hāhā, Endangered); <i>Melicope balloui</i> , <i>Melicope ovalis</i> (alani, alani kuahiwi, Endangered); <i>Huperzia mannii</i> (no Hawaiian name, Endangered)
Closed Koa-‘Ōhi‘a Forest (native shrubs)	
Closed Koa-‘Ōhi‘a Forest (uluhe)	
Closed ‘Ōhi‘a Forest (native shrubs)	
Closed ‘Ōhi‘a Forest (uluhe)	
Low Intensity Developed	
Native Wet Cliff Vegetation	
Open ‘Ōhi‘a Forest (uluhe)	
Uluhe Shrubland	
Uncharacterized Forest	
Uncharacterized Open-Sparse Vegetation	
Uncharacterized Shrubland	

HIGAP Vegetation Classes Found in Critical Habitat Unit	Species found in Critical Habitat Unit (Hawaiian Name, Status)
Montane Wet 01	
Alien Forest	<i>Cyanea duvalliorum</i> , <i>Cyanea maritae</i> , <i>Cyanea mceldowneyi</i> (hāhā, Endangered); <i>Phyllostegia pilosa</i> (no Hawaiian name, Endangered); <i>Melicope balloui</i> (alani, alani kuahiwi, Endangered); <i>Huperzia mannii</i> (no Hawaiian name, Endangered)
Alien Grassland	
Closed 'Ōhi'a Forest (native shrubs)	
Native Wet Cliff Vegetation	
Open 'Ōhi'a Forest (uluhe)	
Uluhe Shrubland	
Uncharacterized Forest	
Uncharacterized Open-Sparse Vegetation	
Montane Wet 02	
Alien Forest	<i>Bidens campylotheca</i> spp. <i>pentamera</i> (ko'oko'olau, ko'olau, Endangered); <i>Clermontia samuelii</i> ('ōhā wai, 'ōhā, hāhā, Endangered); <i>Cyanea copelandii</i> spp. <i>haleakalaensis</i> , <i>Cyanea duvalliorum</i> , <i>Cyanea hamatiflora</i> spp. <i>hamatiflora</i> , <i>Cyanea horrida</i> , <i>Cyanea kunthiana</i> , <i>Cyanea mceldowneyi</i> (hāhā, Endangered); <i>Geranium hanaense</i> , <i>Geranium multiflorum</i> (nohoanu, hinahina, Endangered); <i>Wikstroemia villosa</i> ('ākia, kauhi, Endangered)
Alien Grassland	
Closed Koa-'Ōhi'a Forest (native shrubs)	
Closed Koa-'Ōhi'a Forest (uluhe)	
Closed 'Ōhi'a Forest (native shrubs)	
Closed 'Ōhi'a Forest (uluhe)	
Native Wet Cliff Vegetation	
Open 'Ōhi'a Forest (native shrubs)	
Open 'Ōhi'a Forest (uluhe)	
Uluhe Shrubland	
Uncharacterized Forest	
Uncharacterized Open-Sparse Vegetation	
Uncharacterized Shrubland	
Very Sparse Vegetation to Unvegetated	

5.2 Fauna

The fauna observed in the Study Area includes species that are endemic, indigenous, migratory, and non-native introductions. The endemic, indigenous, and migratory species often require specific niche habitats and are frequently locally abundant where they occur. The non-native introduced species tend to be more generalist and often occupy a broad range of habitats.

The pre-field desktop analysis of HIGAP data identified a mosaic of 24 land cover types in the License and Service Areas. HIGAP land cover types were categorized into wildlife habitat types based on the dominant vegetation and vegetative structure. This was done to simplify the analysis because wildlife often use certain land cover types in similar ways. Table 5 displays HIGAP land cover types categorized into seven wildlife habitat types present in the License Area and/or Service Area.

Table 5. Wildlife Habitat Types

Habitat Type	HIGAP Vegetation Cover Type
Forest	Closed Koa-‘Ōhi‘a Forest (native shrubs)
	Closed ‘Ōhi‘a Forest (native shrubs/uluhe)
	Open ‘Ōhi‘a Forest (native shrubs/uluhe)
	Open ‘Ōhi‘a Forest (native uluhe)
	Alien Forest
	Uncharacterized Forest
Shrubland	Native Shrubland (alien grasses)
	Native Shrubland/Sparse ‘Ōhi‘a (native shrubs)
	Uluhe Shrubland
	Uncharacterized Open-Sparse Vegetation
	Uncharacterized Shrubland
	Alien Shrubs and Grasses
	Alien Shrubland
	Closed Kiawe-Koa Haole Forest and Shrubland
	Open Kiawe Forest and Shrubland (alien grasses)
Grassland	Deschampsia Grassland
	Alien Grassland
	Kikuyu Grass Grassland/Pasture
Stream	Streams and aqueducts (not identified in HIGAP)
Rocky	Very Sparse Vegetation to Unvegetated
Cliff	Native Wet Cliff Vegetation
Developed/Agricultural	Low Intensity Developed
	Agriculture
	High Intensity Developed

Table 6 displays the amount of each wildlife habitat type present in the license and Service Areas. Forest habitat is most abundant in the License Area and developed/agriculture habitat is most abundant in the Service Area (Figure A-5, Appendix A).

Table 6. Area of Wildlife Habitat Types in the Study Area

Habitat Type	License Area (acres)	Service Area (acres)
Forest	29,626	3,233
Shrubland	2,770	1,008
Grassland	233	1,291
Cliff	145	0
Rocky	8	34

Habitat Type	License Area (acres)	Service Area (acres)
Developed/Agricultural	1	30,875
Wetland	0	358
Stream*	168	59
Total	32,783	36,799[†]

* Stream habitat is represented in linear miles and does not contribute to total area.

[†] This total does not include the 9 acres of undefined vegetation class listed in Table 3.

5.2.1 Avifauna

The birds observed in the License Area are species commonly found in low- to mid-elevation mesic and wet forest areas on the northern slope of Haleakalā Volcano. In all, 9 bird species were documented, six of which are protected by the MBTA (Table 7). Of these, three species—‘apapane (*Himatione sanguinea*), Hawai‘i ‘amakihi (*Chlorodrepanis virens wilsoni*), and ‘i‘iwi (*Drepanis coccinea*)—are endemic to Hawai‘i; one is a migratory shorebird and two are non-native introductions. The ‘i‘iwi is the only federally and state-listed bird that was detected during ground surveys and was identified by vocalizations. In addition to ‘i‘iwi, the federally and state-listed Maui parrotbill (*Pseudonestor xanthophrys*) and crested honeycreeper (*Palmeria dolei*) are known to occur in mesic and wet forest above approximately 3,937 feet (1,200 meters [m]) (Pratt et al. 2009).

Birds observed in the Service Area are species commonly found in disturbed, low-elevation areas on Maui’s central plain. In all, 24 birds were documented, 13 of which are protected by the MBTA (see Table 7). Of the 13 MBTA-protected birds, three birds are federally and state listed; two are endemic; two are migrant waterfowl; one is a migrant shorebird; one is an indigenous waterbird, and four are non-native introductions. The federally and state-listed species are discussed in more detail in Section 5.2.5.

Table 7. Birds Observed by SWCA in and near the Service and License Areas

Common Name	Scientific Name	Status*	Detection Area	Protected under MBTA
‘Apapane	<i>Himatione sanguinea</i>	E	LA	X
Hawai‘i ‘amakihi	<i>Chlorodrepanis virens wilsoni</i>	E	LA	X
Black-crowned night-heron	<i>Nycticorax</i>	I	SA	X
Cattle egret	<i>Bubulcus ibis</i>	NN	SA	X
Chestnut munia	<i>Lonchura atricapilla</i>	NN	LA, SA	
Chicken	<i>Gallus domesticus</i>	NN	SA	
Common myna	<i>Acridotheres tristis</i>	NN	SA	
‘i‘iwi	<i>Drepanis coccinea</i>	FT,ST	LA	X
Green-winged teal	<i>Anas crecca</i>	M	SA	X
Grey francolin	<i>Francolinus pondicerianus</i>	NN	SA	
Japanese white-eye	<i>Zosterops japonicus</i>	NN	LA, SA	
Mallard	<i>Anas platyrhynchos</i>	M	SA	X
Melodious laughing thrush	<i>Garrulax canorus</i>	NN	LA	
Mourning dove	<i>Zenaida macroura</i>	NN	SA	X
Hawaiian coot	<i>Fulica americana alai</i>	FE, SE	SA	X

Common Name	Scientific Name	Status*	Detection Area	Protected under MBTA
Hawaiian stilt	<i>Himantopus mexicanus knudseni</i>	FE, SE	SA	X
House finch	<i>Haemorhous mexicanus</i>	NN	LA, SA	X
House sparrow	<i>Passer domesticus</i>	NN	SA	
Java sparrow	<i>Lonchura oryzivora</i>	NN	SA	
Northern cardinal	<i>Cardinalis cardinalis</i>	NN	LA	X
Pacific golden-plover	<i>Pluvialis fulva</i>	M	LA, SA	X
Red-crested cardinal	<i>Paroaria coronata</i>	NN	SA	
Spotted dove	<i>Streptopelia chinensis</i>	NN	SA	
Zebra dove	<i>Geopelia striata</i>	NN	SA	
Total		24		13

* E = endemic; FE = federally endangered; FT = federally threatened; I = indigenous; LA = License Area; M = migrant; NN = non-native permanent resident; SA = Service Area; SE = state endangered, ST = state threatened.

5.2.2 Mammals

Mammals detected during the surveys include cow (*Bos taurus*), feral pig (*Sus scrofa*), and feral cat (*Felis catus*). No other mammals were observed during the ground surveys, although rat (*Rattus spp.*), mongoose (*Herpestes javanicus*), and mouse (*Mus musculus*) could be expected to occur. Cattle were only observed in the License Area; all other mammals likely occur in both the License Area and Service Area.

5.2.3 Terrestrial Reptiles and Amphibians

No terrestrial reptiles or amphibians are native to Hawai‘i. Terrestrial reptiles or amphibians were not detected during the ground surveys.

5.2.4 Insects and other Invertebrates

Twelve invertebrates were observed during the surveys, consisting of the Blackburn’s damselfly (*Megalagrion blackburni*), Hawaiian upland damselfly (*Megalagrion hawaiiense*), citrus swallowtail butterfly (*Papilio xuthus*), Monarch butterfly (*Danaus plexippus*), housefly (*Musca domestica*), smaller lantana butterfly (*Strymon bazochii*), mud dauber (*Sceliphron caementarium*), wandering glider (*Pantala flavescens*), green darner (*Anax junius*), Aedes mosquito (*Aedes sp.*), walking stick (*Sipyloidea sipyilus*), and witch moth (*Ascalapha odorata*). All these invertebrates are common in East Maui. Excluding the damselfly species, they are also common in Central Maui.

5.2.5 Special-Status Fauna and Critical Habitat

Special-status fauna refers to wildlife species listed by the USFWS and the State of Hawai‘i as threatened, endangered, or candidate. These species are discussed in detail below.

The USFWS lists 19 species that may occur in the Study Area: 18 endangered species and one threatened species (Table E-1, Appendix E). The ‘i‘iwi was classified as threatened on October 20, 2017, after the list was created and is included here. The following section discusses the special-status species observed and the special-status species that have the potential to occur in the License and Service Areas based on historical records, available habitat, and the USFWS list of ESA-listed species (USFWS 2016a).

Three special status species—‘i‘iwi, Hawaiian coot, and Hawaiian stilt—were detected during the surveys. The ‘i‘iwi was detected below 1,500 feet in the forest habitat of the License Area. The Hawaiian coot was observed foraging in the holding ponds in the Service Area. The Hawaiian stilt was observed loafing along the access roads and foraging in the holding ponds of the Service Area. Aerial and GIS database review of environmental resources identified the presence of designated critical habitat for the Maui parrotbill and crested honeycreeper in the Southeastern section of the License Area (USFWS 2003a, 2016b) (Figure A-6, Appendix A). Maui parrotbill critical habitat in the License Area consists of 4,573 acres that occurs from approximately 3,700 feet to 7,400 feet. Crested honeycreeper critical habitat in the License Area consists of 2,789 acres that occurs from approximately 4,100 feet to 7,400 feet. Thirteen special-status species could occur in the Study Area based on habitat: crested honeycreeper, Maui parrotbill, ‘i‘iwi, Hawaiian duck (*Anas wyvilliana*), Hawaiian goose (*Branta sandvicensis*), Hawaiian petrel (*Pterodroma sandwichensis*), Newell’s shearwater (*Puffinus auricularis newelli*), band-rumped storm-petrel (*Oceanodroma castro*), Hawaiian hoary bat (*Lasiurus cinereus semotus*), Blackburn’s sphinx moth (*Manduca blackburni*), flying earwig Hawaiian damselfly (*Megalagrion nesiototes*), Pacific Hawaiian damselfly (*Megalagrion pacificum*), and orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*).

The potential for the presence of Hawaiian hoary bat was assessed based on the presence of suitable habitat. The Hawaiian hoary bat has been documented roosting in ‘ōhi‘a, albizia (*Falcataria moluccana*), coconut, ironwood, eucalyptus, hala (*Pandanus tectorius*), hau, kiawe, kukui (*Aleurites moluccana*), macadamia (*Macadamia integrifolia*), mango, and pūkiawe (*Leptecophylla tameiameia*) and could roost in trees similar in structure. In addition, the Hawaiian hoary bat could forage over all the vegetation types throughout the Study Area.

Table 8 links special status fauna species with the potential to be found in the Study Area with wildlife habitat types.

Table 8. Special-Status Fauna with the Potential to Occur in the Study Area

Habitat Type	Special-Status Fauna
Forest	Maui parrotbill, ‘i‘iwi, crested honeycreeper, Hawaiian hoary bat, Hawaiian petrel, Newell’s shearwater, and band-rumped storm-petrel
Shrubland	Hawaiian goose, Hawaiian hoary bat, Hawaiian petrel, Newell’s shearwater, and band-rumped storm-petrel
Grassland	Hawaiian hoary bat, Hawaiian goose, Hawaiian petrel, Newell’s shearwater, and band-rumped storm-petrel
Stream	Hawaiian coot, Hawaiian duck, Hawaiian stilt, Hawaiian goose, Hawaiian hoary bat, flying earwig Hawaiian damselfly, Pacific Hawaiian damselfly, and orangeblack Hawaiian damselfly
Rocky	Hawaiian goose, Blackburn’s sphinx moth larvae, Hawaiian hoary bat, Hawaiian petrel, Newell’s shearwater, band-rumped storm-petrel
Cliff	Hawaiian hoary bat, Hawaiian petrel, Newell’s shearwater, band-rumped storm-petrel, flying earwig Hawaiian damselfly
Developed/Agricultural	Hawaiian goose, Blackburn’s sphinx moth larvae, Hawaiian hoary bat

Approximate elevation ranges of where special-status fauna are known to occur are as follows:

- Crested honeycreeper: 3,600 to 7,550 feet (Conant 1981; Scott et al. 1986; USFWS 2003a)
- Maui parrotbill: 4,000 to 7,700 feet (Mountainspring 1987; Scott et al. 1986; Simon et al. 1997; USFWS 2003a)
- ‘I‘iwi: above 3,937 feet (USFWS 2017a)

- Hawaiian duck: sea level to 7,000 (USFWS 2011)
- Hawaiian goose: sea level to 8,000 feet (USFWS 2004)
- Hawaiian petrel: above 7,200 feet (USFWS 1983)
- Newell's shearwater: 500 to 2,300 (USFWS 1983)
- Band-rumped storm-petrel: 1,950 to 3,900 feet and on Lehua Islet below 650 feet (Mitchell et al. 2005)
- Hawaiian hoary bat: sea level to 13,200 (Baldwin 1950; Fujioka and Gon 1988; Kepler and Scott 1990; Tomich 1974; USFWS 1998)
- Blackburn's sphinx moth: sea level to 5,000 feet (USFWS 2003b)
- Flying earwig Hawaiian damselfly: up to 3,000 feet (USFWS 2017b)
- Pacific Hawaiian damselfly: below 2,000 feet (USFWS 2017b)
- Orangeblack Hawaiian damselfly: 3,280 feet (Polhemus and Asquith 1996)

6 IMPACTS

This section identifies the types of effects that could occur as a result of the proposed Water Lease, specifically whether the effects are temporary, short term, or long term and whether the effects are direct or indirect. This analysis uses the terms *effect* and *impact* interchangeably, and each has the same intended meaning.

Effects analysis was conducted using the results of field surveys and the likely effects to existing occurrences and habitat from the proposed activities based on the literature and professional judgment. Avoidance and minimization measures (Section 7) were also developed to avoid or minimize detrimental impacts to plant species and habitat. If these measures are committed to be included as part of the Water Lease, actual impacts would be fewer than described in this document.

The Proposed Action consists of the issuance of one long-term Water Lease from the BLNR for the continued right, privilege, and authority to enter and go upon the License Area (see Figure A-1, Appendix A) for the purpose of developing, diverting, transporting, and using government-owned waters through the existing EMI Aqueduct System, which supplies water to domestic and agricultural water users. Since there is no habitat removal or loss proposed, impacts are not quantified but are described in qualitative terms.

6.1 Proposed Action

In this analysis, the term *fauna*, or *wildlife*, applies to any mammals, birds, reptiles, or amphibians with the potential to occur in the vicinity of the Proposed Action. *Habitat* refers to an area that contains the resources (food, water, and cover) necessary for the survival of a particular species or group of species.

The IIFS for East Maui streams describes four categories of streams with related streamflow restoration types (CWRM 2018; see Trutta 2018 for category definitions). These four types, along with the streams in the License Area that fall in each type, are presented in Table 9.

Table 9. License Area Streams Subject to the IIFS Decision and their Restoration Type

Stream	Streamflow Restoration Type			
	Full	Habitat (H ₉₀)	Connectivity	None
Makapipi	X			
Waiohue	X			
West Wailuaiki	X			
Wailuanui	X			
Waiokamilo	X			
Palauhulu	X			
Piinaau	X			
Hanahoi	X			
Huelo/Puolua*	X			
Honopou	X			
Kopiliula		X		
East Wailuaiki		X		
Honomanu		X		
Punalau		X		
Waikamoi		X		
Hanawi			X	
Kapaula			X	
Paakea			X	
Nuaailua			X	
Haipuaena			X	
Pouhokamoa			X	
Puaakaa*			X	
Waiaaka				X
Ohia/Waianu				X
Wahinepee				X
Total	10	5	7	3

* Puolua (also known as Huelo) Stream, is a tributary to Hanahoi Stream, and per the June 20, 2018, CWRM IIFS D&O, was ordered to be fully restored and is included in the count of "Fully Restored Streams."

* Puaakaa stream is a tributary to Kopiliula Stream, and per the June 20, 2018, CWRM IIFS D&O, was ordered to be restored as a "Connectivity Stream."

6.1.1 General

The Proposed Action does not require vegetation removal except for routine maintenance purposes. As such, the amount of each vegetation cover type currently present in the Study Area (see Tables 2 and 3), would remain substantially the same. For this reason, there would be no direct impacts to flora or fauna due to the Proposed Action. The main action under the Proposed Action is the diversion of water by the existing EMI Aqueduct System infrastructure for water delivery purposes. This action in and of itself would have no impact on terrestrial flora or fauna resources.

The presence of the aqueducts and associated access roads increases fragmentation in otherwise continuous habitat patches. Habitat fragmentation increases the amount of edge habitat, which can alter the composition of species present in any one area. This is because certain species, often special-status species and those that grow or breed in unique habitat conditions, often occur in core habitat patches away from edges. However, the Proposed Action proposes to continue the use of and access to the existing infrastructure at current levels and does not propose to increase infrastructure or access to it. Most of the aqueducts and access roads were built historically and have been in use for many years. For this reason, implementation of the Proposed Action would not increase habitat fragmentation over current conditions.

Approval of diverted water use under the Proposed Action may support diversified agriculture on agricultural lands in the Service Area. This is because it has been stated that the goal is to transition to diversify agriculture, should the long-term water lease be issued. Production of a single crop over a large area, such as sugarcane, provides a monoculture environment for flora and fauna, leading to population increases of certain, often weedy and generalist, species. Increasing the diversity of crops increases the niches in which flora and fauna can establish and would be beneficial to some flora and fauna because the agricultural lands would provide an increased diversity of foraging, breeding, and nesting resources. In general, increased diversity in croplands could lead to an increased diversity of flora and fauna.

6.1.2 *Flora*

Under the Proposed Action, EMI would be granted the right to “enter and go upon” the License Area for aqueduct maintenance activities. Some of these activities would entail vegetation maintenance (trimming or removal for access) and vegetation trampling by vehicles or humans, both of which would have a negligible impact on the existing flora. Maintenance activities could also increase the potential for weed introduction and invasion because undesirable seeds may be present on vehicles, equipment, and clothing. Weeds, by definition, can outcompete most flora for space and nutrient resources. Weed invasions, if they were to occur, would decrease the quality and quantity of habitat available for native plant species. However, current conditions are not expected to change given that implementation of the Proposed Action would not change current conditions.

6.1.3 *Fauna*

The presence of vehicles and humans for maintenance activities could disrupt the normal behavior of wildlife and temporarily displace individuals from roadside habitat. However, it is anticipated that maintenance activities would only take place sporadically, and so wildlife would resume normal behavior shortly after the passage of the vehicle or completion of the maintenance activity. However, maintenance activities currently take place and have for the duration of water diversion activities in the License Area. As such, the Proposed Action would not increase human noise and activity above current levels. The presence of human noise and activity would have a negligible effect on wildlife.

6.1.3.1 SPECIAL-STATUS SPECIES AND CRITICAL HABITAT

Under the Proposed Action, there would be the potential for fauna to be struck and killed or injured by vehicles that are on-site for maintenance activities. Certain species are more likely to be struck by vehicles than others. In the context of the Water Lease, the Hawaiian goose is the only special-status species with more than a low potential to be struck by a vehicle. However, given that the proposed Water Lease is essentially a continuation of water diversions that have been taking place within the License Area for over one hundred years, and maintenance activities have been conducted throughout that time, the potential for vehicle strikes would not increase with implementation of the Proposed Action.

If tree removal occurs during the bat breeding season (June 1 to September 15), direct impacts could occur to juvenile bats that are too small to fly but too large to be carried by a parent.

Tree tobacco, a common host plant for Blackburn sphinx moth larvae, was observed in the Service Area. Removal of this species and other common host plants could result in sphinx moth egg and larvae fatalities.

Under the Proposed Action, conditions in the License Area would more closely approximate natural flow than diversions under sugar cane production (i.e., highly diverted conditions immediately below each diversion) (Trutta 2019). Under the Proposed Action, habitat for flying earwig Hawaiian damselfly, Pacific Hawaiian damselfly, and orange black Hawaiian damselfly (collectively Hawaiian damselflies) would increase in 19 streams and decrease in three streams (see Table 9; Table 10). However, the restoration of IIFS-mandated flows would also improve habitat conditions for a number of introduced predator and competitor species of the Hawaiian damselflies, and therefore may not actually result in an increase of damselfly populations because of this increased predation (Trutta 2019).

Habitat for the southern house mosquito (*Culex quinquefasciatus* [mosquito]) would decrease overall because increased streamflow would reduce standing water that provides breeding habitat for the species. This would be beneficial to the Hawaiian honeycreeper (*Passeriformes drepanididae*) because it would reduce the likelihood, abundance, and potential for transmission of avian malaria, which is a vector-borne disease.

Table 10. Proposed Action Impact of Stream Restoration Type on the Habitat of Special-Status Hawaiian Damselflies and Mosquitos

Stream Restoration Type	Number of Streams	Hawaiian Damselfly Habitat	Mosquito Habitat
Full	10	Increase	Decrease
Habitat	5	Increase	Decrease
Connectivity	7	Increase	Decrease
None	3	Decrease	Decrease

The Study Area provides suitable nesting habitat for Hawaiian seabirds. Breeding individuals may fly over the Study Area at night while traveling between upland nesting and ocean foraging sites. Disorientation and fallout as a result of light attraction could occur to individuals attracted to nighttime lighting. However, there is very little current nighttime lighting in the License Area, and implementation of the long-term Water Lease would not increase current nighttime lighting conditions in the Study Area overall. It is unlikely that maintenance activities would necessitate nighttime lighting. For these reasons, implementation of the Proposed Action would not increase the current risk of seabird fallout.

Impacts to critical habitat for the Maui parrotbill and crested honeycreeper are similar to the flora impacts discussed above in Section 6.1.2. Vegetation maintenance activities could increase the potential for invasive nonnative (alien) plant and animal species introduction and invasion. Alien plant and animal species are rarely unaccompanied and are collectively the greatest threat to Hawaii forest bird habitat (Pratt et al. 2009). Weed invasions, if they were to occur, may increase the populations of alien plant and animal species that currently exist, increase the likelihood of new alien plant and animal introductions, and would decrease the quality of critical habitat available for the Maui parrotbill and crested honeycreeper. However, current conditions are not expected to change given that implementation of the Proposed Action would not change current conditions.

6.2 No Action Alternative

The No Action Alternative would result in no Water Lease being issued by the State. Under the No Action Alternative, the EMI Aqueduct System would continue to divert non-government-owned water from the Collection Area (i.e., approximately 30 percent of the water available from the Collection Area). Should this be sufficient for EMI to continue operation and maintenance of the system, then the activities would have impacts comparable to the Proposed Action. Should EMI abandon the aqueduct system, no water would be diverted from the Collection Area or delivered to the Service Area; road and aqueduct maintenance activities would not take place. As a result, human noise and activity along the EMI Aqueduct System would be reduced from current levels to none. This would be beneficial for plants and wildlife because there would be no potential for vehicle strikes, crushing, or displacement. The roads and the EMI Aqueduct System would go into disrepair and likely become overgrown, which could reduce or reverse current levels of habitat fragmentation. Increased water flows in the streams would likely have very little impact on terrestrial flora and fauna. Impacts on aquatic flora and fauna (i.e., damselflies and mosquitoes) would vary depending on the eventual condition of each stream (Trutta 2019).

With a significantly reduced water delivery to the Service Area, it is likely that some proportion of the agricultural fields would be abandoned and become fallow, especially if securing new sources of water is cost prohibitive. If the EMI Aqueduct System is abandoned, an even greater amount of land would become fallow. In Central Maui, the abandonment of fields would result in a pattern of succession of weedy plants, beginning with herbaceous species and grasses such as wild sugarcane (*Saccharum spontaneum*), Guinea grass, and swollen fingergrass. Tree tobacco, castor bean, and woody species such as African tulip, albizia, Java plum, and Christmas berry would ultimately follow. Few to no native species would colonize the fields in the foreseeable future. Holding ponds would dry up and fill in, which would eliminate nest and foraging habitat for endangered Hawaiian waterbirds and foraging habitat for migrant shorebirds and migrant waterfowl. Assuming the lands in the Service Area continue to remain fallow, over time, biodiversity could gradually rise as the establishment of woody species would increase the complexity of the habitat structure, which would provide more nesting opportunities for MBTA-listed birds such as cattle egret, northern cardinal, mourning dove, and house finch. The potential for tree tobacco to colonize abandoned fields would be beneficial for the Blackburn's sphinx moth because it would increase available breeding habitat.

6.3 Water Lease Volume Alternative

The Water Lease Volume alternative is understood as a modification (reduction) to the volume of water that is diverted from East Maui streams that would be available for diversion under the CWRM IIFS D&O. As a consequence of this alternative, the overall amount of water that could be diverted to meet domestic and agricultural water demands in Upcountry Maui, as well as the community of Nāhiku, and agricultural demands in Central Maui would be reduced. As a result, the EMI Aqueduct System would require more routine maintenance of the open ditches due to vegetation growth within the ditches and access into the License Area due to less flowing water in the system. Human noise and activity along the EMI Aqueduct System would increase from current levels. This would increase the potential for negative impacts such as vehicle strikes, crushing, or displacement from current levels. The increased water flows in the streams would likely have very little impact on terrestrial flora and fauna. Impacts on aquatic flora and fauna (i.e., damselflies and mosquitoes) would vary depending on the eventual condition of each stream (Trutta 2019).

If the Water Lease is issued and does not authorize the use of sufficient amounts of water needed for the lessee to pursue diversified agriculture in the Service Area, alternative sources might be pursued, such as the construction of new wells, desalinization facilities, or reservoirs. The effects are comparable to those of the No Action Alternative. With less water awarded from what would be available to divert in

compliance with the CWRM IIFS D&O, it is likely that some proportion of the agricultural fields would be abandoned and become fallow, especially if securing new sources of water is cost prohibitive. If the EMI Aqueduct System is abandoned, an even greater amount of land would become fallow. The effects of field abandonment in the Service Area would be identical to those described for the No Action Alternative.

6.4 Water Lease Term Alternative

The Water Lease Term Alternative is understood as a modification to the term for which the Water Lease will be awarded for other than the proposed term of 30 years. As a consequence of this alternative, should the lease term be shorter, diversified agriculture may not be able to come to fruition in Central Maui (i.e., the Service Area).

The term may be too short or risky to initiate and maintain a large scale diversified agricultural operation. As a result, the agricultural fields may be abandoned and an even greater amount of land would become fallow. The effects of field abandonment in the Service Area would be identical to those described for the No Action Alternative.

6.5 Management Alternative

The Management Alternative is understood as a change of the entity that manages the diversion of water from East Maui streams. Currently, the EMI Aqueduct System is managed by the East Maui Irrigation Company in partnership with Mahi Pono, LLC. As a consequence of this alternative, the EMI Aqueduct System would in turn be managed by another entity other than the current operators. This alternative would be comparable to the Proposed Action.

Should another entity manage the diversion of water from the East Maui streams, the EMI Aqueduct would still require maintenance, and therefore there would still be a need for access into the License Area. Effects from the Management Alternative, would be identical to those described under the Proposed Action.

6.6 Greater Public Access Alternative

The Greater Public Access Alternative is understood as the License Area being reduced in size that only covers the area where the EMI Aqueduct System and existing access roads (presumably with an additional buffer area), allowing more public access into the area from current levels. As a result, the current License Area would see an increase in public access.

An increase in public access to the current License Area as part of any proposed project alternative would have a potential impact to the flora and fauna species that are present in the License Area. Access into the License Area would presumably allow for hiking, hunting, gathering, and other recreational and/or cultural activities to take place. These activities would result in vegetation trampling, which, depending on degree of access and use of the area, may have a significant impact on existing flora. In addition, the potential for weed introduction and invasion would increase. Weeds, by definition, can outcompete most flora for space and nutrient resources. Weed invasions, if they were to occur, would decrease the quality and quantity of habitat available for native plant species, which in turn may decrease the quality of critical habitat for the Maui parrotbill and crested honeycreeper. The presence of vehicles and humans for various activities in the License Area could disrupt the normal behavior of wildlife and temporarily displace individuals from roadside habitat. Human noise and activity would increase due to an increase in access, which would have a negative impact on wildlife.

7 AVOIDANCE AND MINIMIZATION MEASURES

7.1 Flora

Although no plant species listed or proposed for listing as threatened or endangered under the ESA or candidates for possible future listing as threatened or endangered under the ESA were found during ground surveys of the License Area, portions of the aqueducts transect wet cliffs and other suitable habitat for these species. For this reason, a botanical monitor should be on-site during any maintenance activities on cliff-sides, near waterfalls, and in other native species-dominated areas to ensure that no listed or candidate species are impacted. The botanical monitor should possess the following qualifications:

- Familiarity with the plants of the area, including special-status species
- Familiarity with natural communities of the area, including special-status natural communities;
- Experience conducting floristic field surveys
- Experience with analyzing impacts of development on native plant species and natural communities

To avoid the unintentional introduction or transport of new invasive plant species into more pristine portions of the License Area during aqueduct maintenance activities, all equipment and vehicles arriving from outside the License Area should be washed and inspected prior to any maintenance activities on cliff-sides, near waterfalls, and in other native species-dominated areas in the License Area. In addition, construction materials arriving from outside Maui should also be washed and/or visually inspected (as appropriate) for excessive debris, plant materials, and invasive or harmful non-native species (plants, amphibians, reptiles, and insects). When possible, any raw materials used in maintenance activities should be purchased from a local supplier on Maui to avoid introducing non-native species not present on the island. Inspection and cleaning activities should be conducted at a designated location.

The inspector must be a qualified botanist/entomologist able to identify invasive species that are of concern relevant to the point of origin of the equipment, vehicle, or material. Invasive species that should be checked for during inspections can be found at the following online locations:

- U.S. Department of Agriculture, Hawai‘i State-listed Noxious Weeds: <http://plants.usda.gov/java/noxious?rptType=State&statefips=15>
- Maui Invasive Species Committee Target Pests: <http://mauiinvasive.org/misc-target-pests/>

7.2 Fauna

To minimize potential impacts to fauna, the following measures should be followed:

- Regular on-site staff should be trained to identify special-status species with the potential to occur on-site and should know the appropriate measures to be taken if they are present.
- If tree trimming occurs in the ‘i‘iwi, Maui parrotbill and crested honeycreeper range (as defined in Section 5.2.5) from November to June, a qualified biologist should survey the trees for active nests of these species.
- If a downed tree must be removed from a road, trail, or other passageway, it will be inspected for the presence of active bird nests, specifically the nest of an MBTA-protected species, that may have been present prior to the tree falling. If an active nest is found, it should be protected in place until the chicks fledge.

- If a Hawaiian goose, Hawaiian stilt, or Hawaiian coot is observed in the area during construction activities, all activities within 100 feet (30 m) of the species should cease, and work should not continue until the species leaves the area on its own accord.
- If a Hawaiian goose nest is discovered, all activities within 150 feet (46 m) of the nest should cease, and the USFWS should be contacted. Work should not resume until directed by the USFWS.
- If felling of standing trees occurs during the bat breeding season, direct impacts could occur to juvenile bats that are too small to fly but too large to be carried by a parent. To minimize this impact, no trees taller than 15 feet (4.6 m) should be trimmed or removed between June 1 and September 15.
- The use of barbless top-strand wire is recommended for all fence construction to avoid entanglement of Hawaiian hoary bat.
- A survey for potential larval host plants for Blackburn's sphinx moth (particularly tree tobacco) should be conducted by biologists before construction/vegetation clearing. Results of the survey should be provided to the USFWS.
- If host plants are found, surveys for Blackburn's sphinx moth should be performed according to the most recent USFWS guidance, and preferably during the wet season (January to April), roughly 4 to 8 weeks following a significant rainfall event. Results of the survey should be provided to the USFWS. Any necessary follow-up actions should be coordinated with the USFWS.
- A qualified biologist should work closely with the USFWS and monitor ESA-listed damselflies to ensure activities do not have a negative impact.

7.2.1 Seabirds

To minimize potential impacts to seabirds, the following measures should be followed:

- Construction activity should be restricted to daylight hours as much as practicable during the seabird peak fallout period (September 15 to December 15) to avoid the use of nighttime lighting that could attract seabirds.
- All outdoor lights should be shielded to prevent upward radiation. This has been shown to reduce the potential for seabird attraction. A selection of acceptable, seabird-friendly lights can be found online at the Kauai Seabird Habitat Conservation Program website: <http://www.kauai-seabirdhcp.info/lighting-homes-businesses/>.
- Outside lights not needed for security and safety should be turned off from dusk through dawn during the fledgling fallout period (September 15 to December 15).

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APPENDIX A

Maps

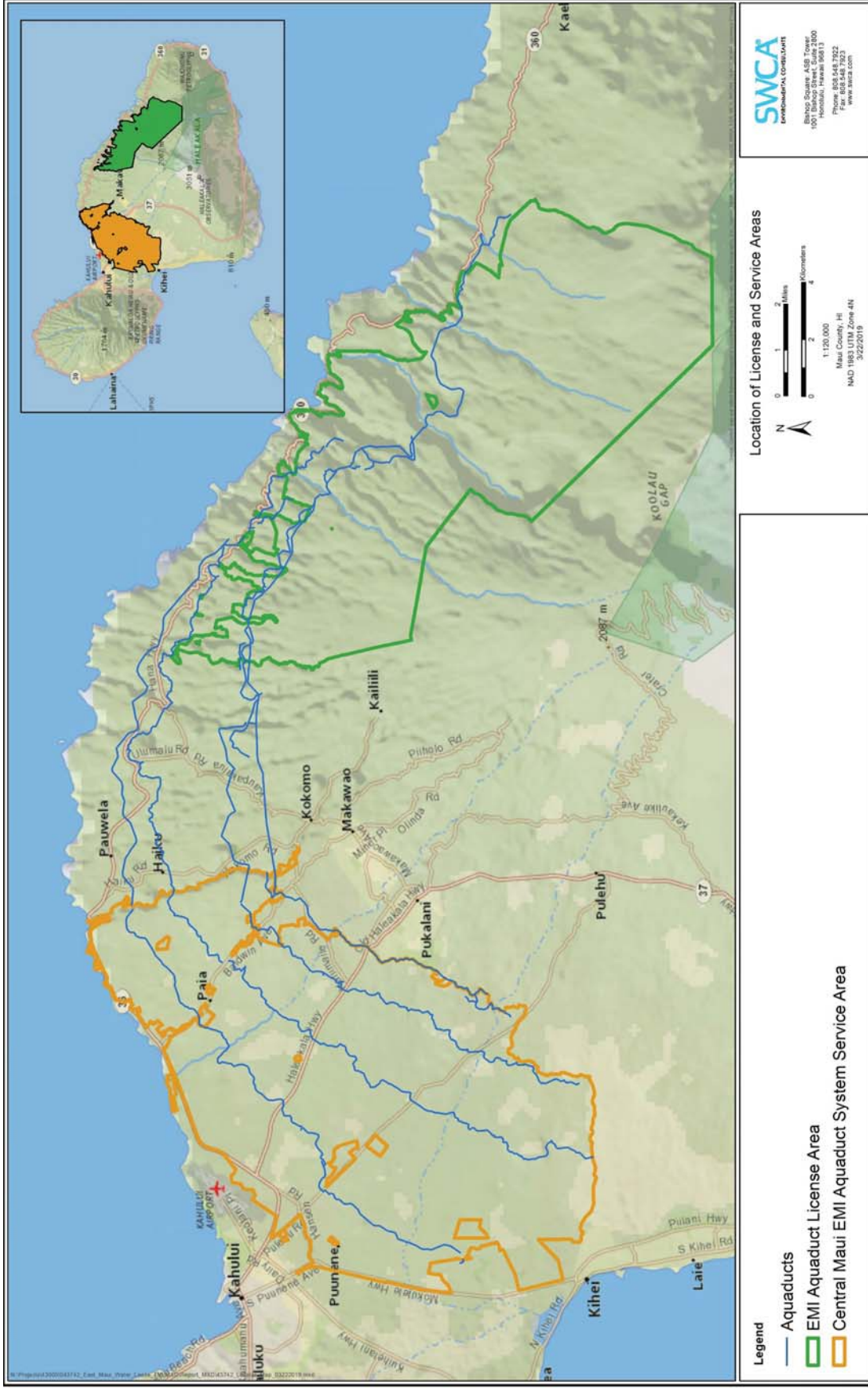


Figure A-1. Location of License and Service Areas.

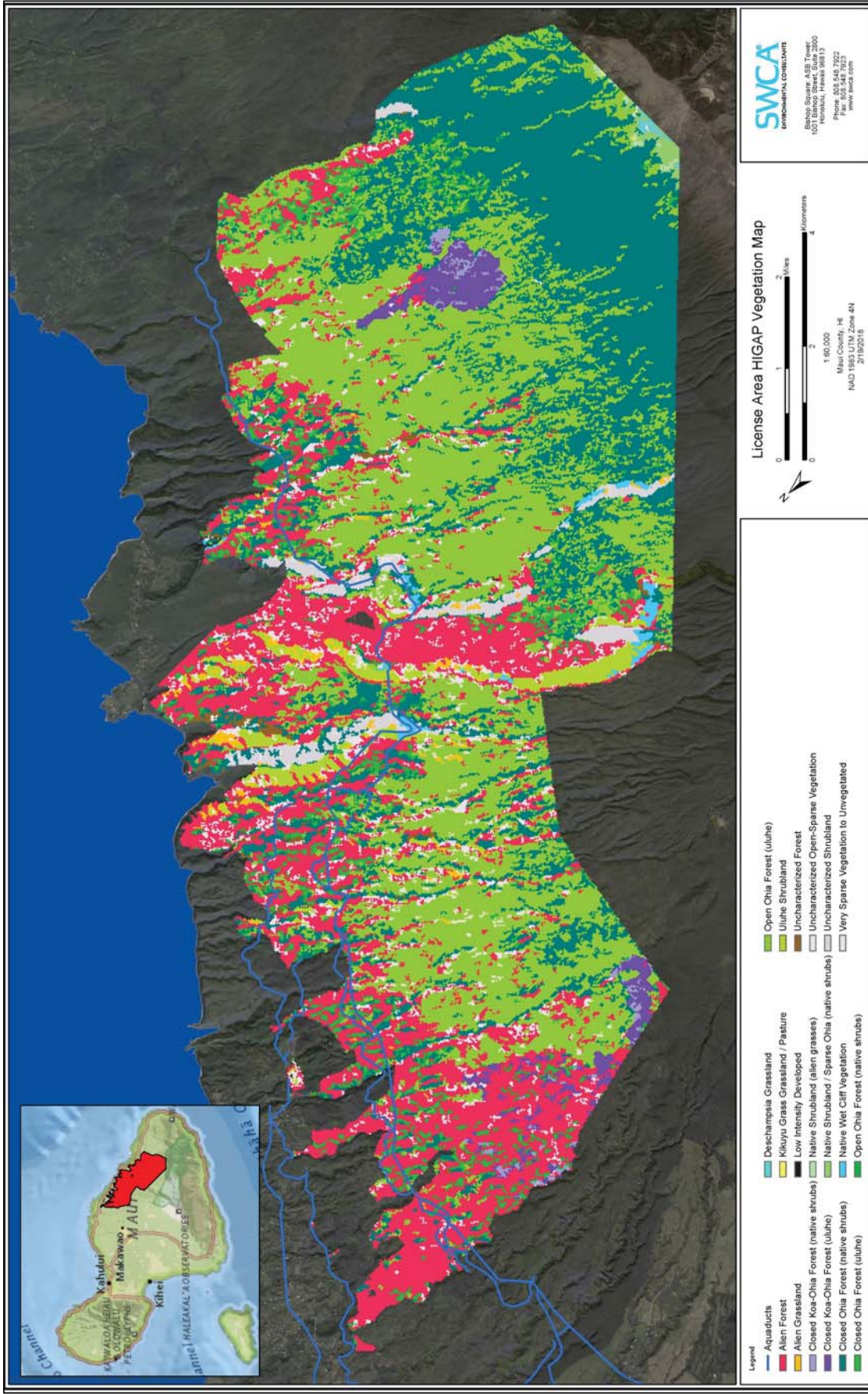


Figure A-2. License Area HIGAP vegetation classes.

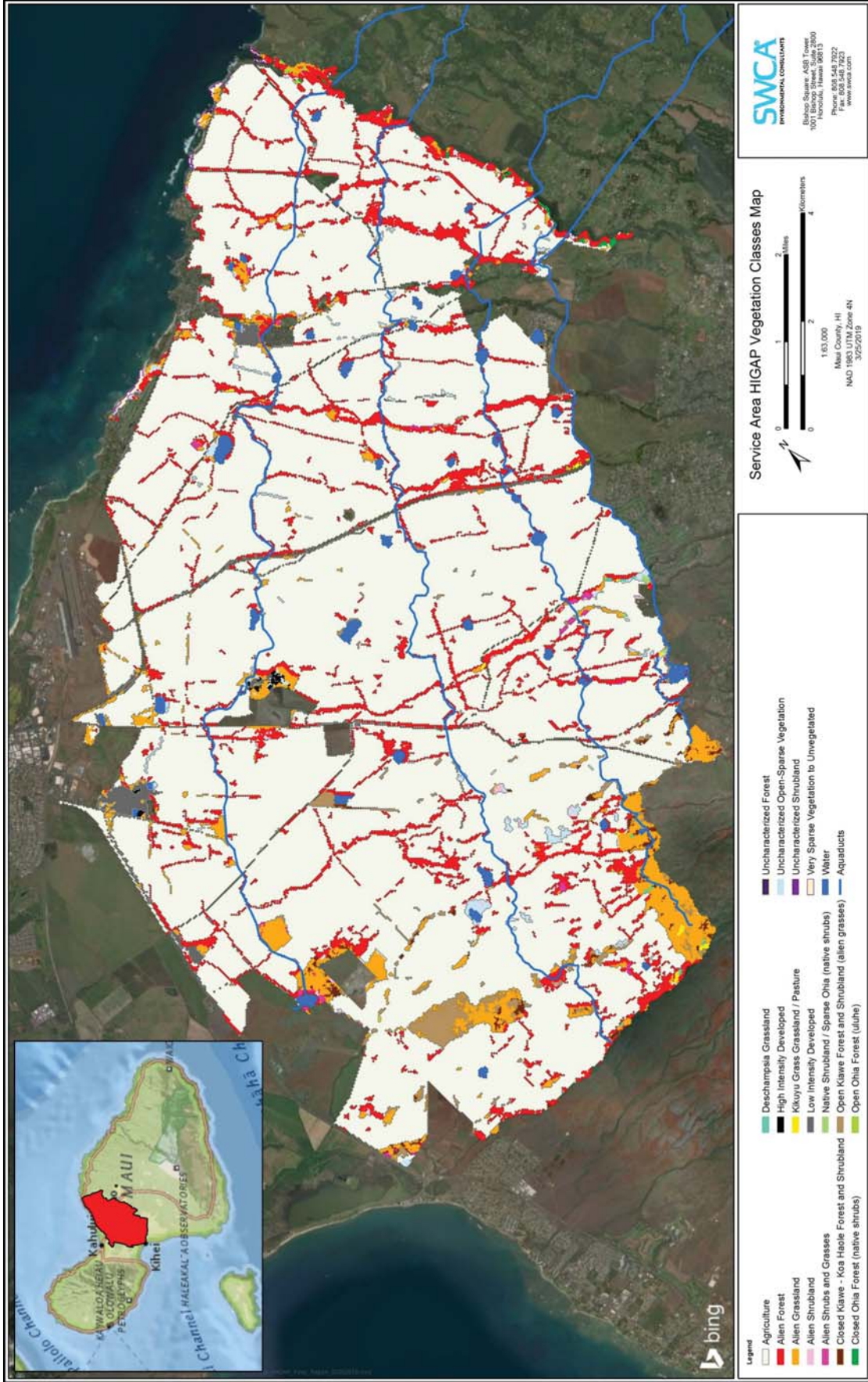


Figure A-3. Service Area HIGAP vegetation classes.

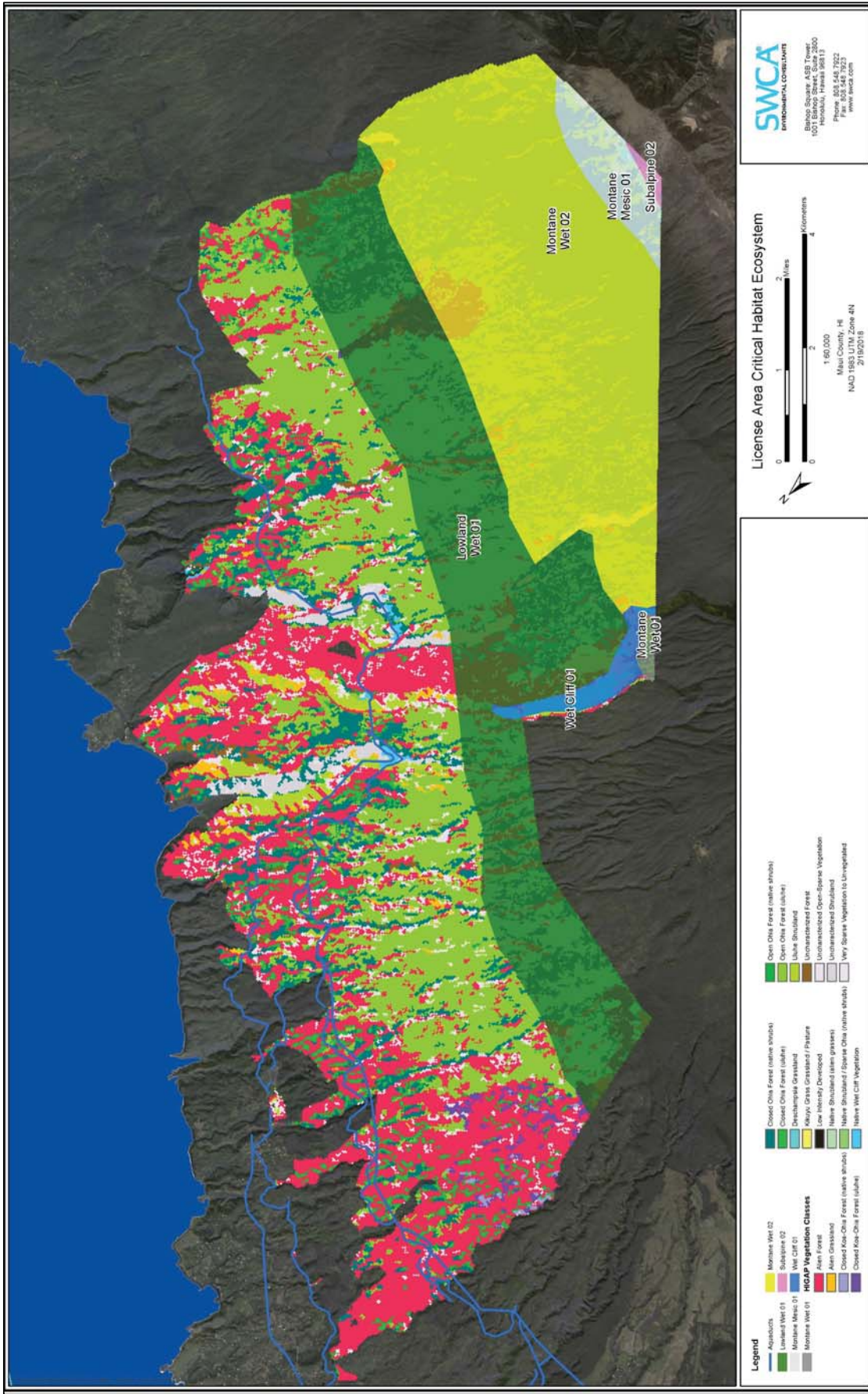


Figure A-4. License Area critical habitat ecosystem.

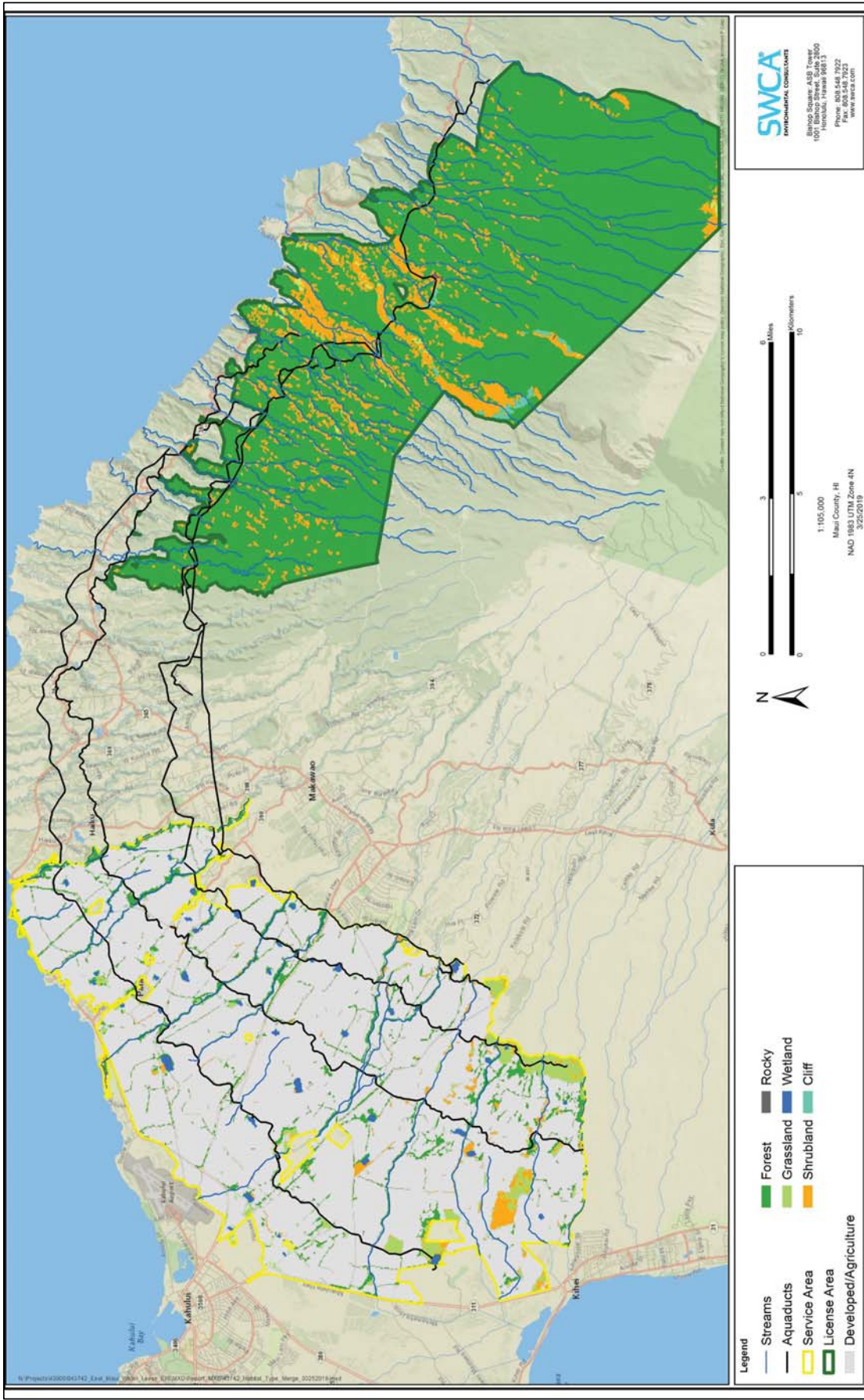


Figure A-5. Wildlife habitat types.

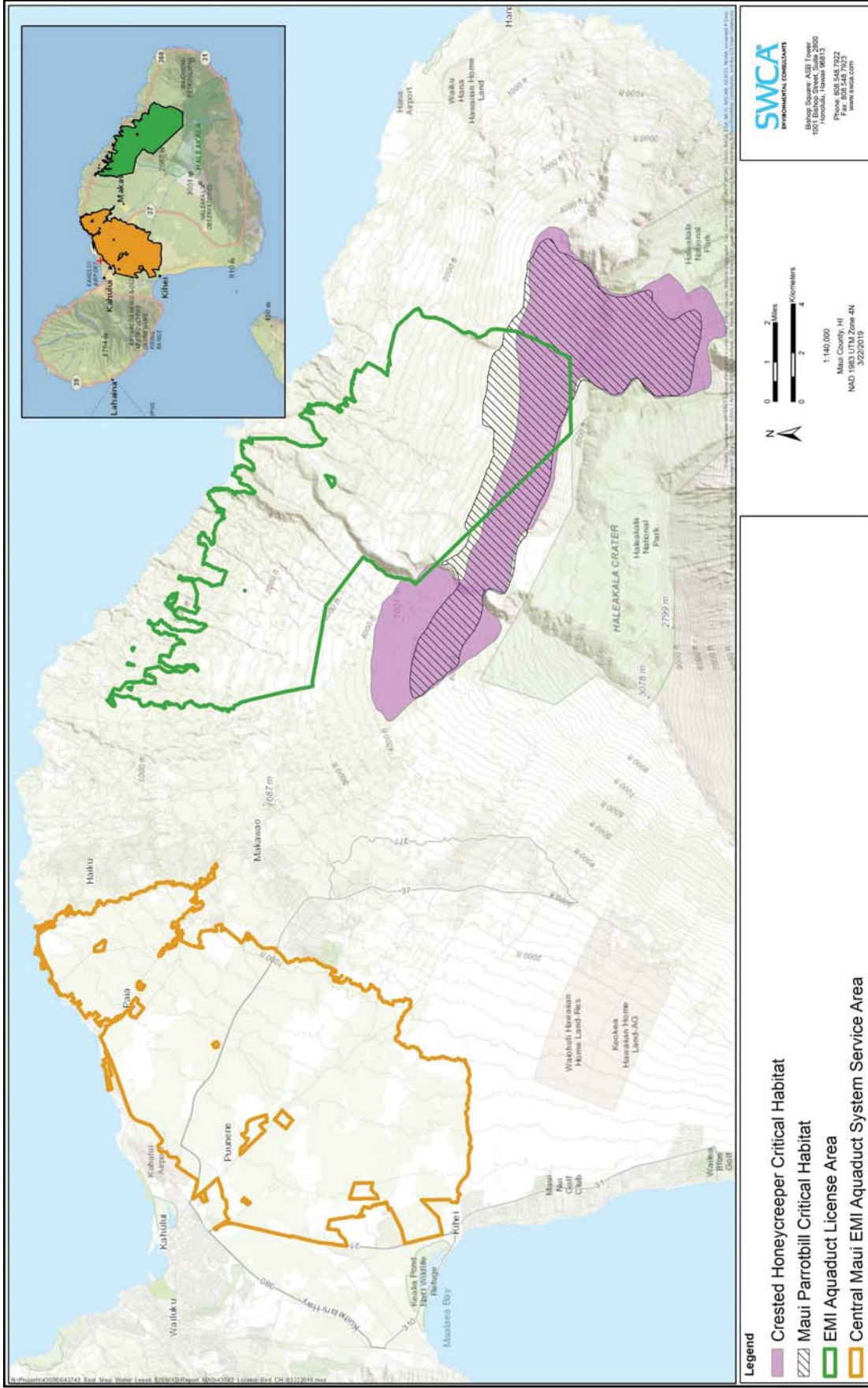


Figure A-6. Maui parrotbill and crested honeycreeper critical habitat.

APPENDIX B

Vegetation Cover Descriptions

Table B-1. Vegetation Cover Types Present in the License and Service Areas

Vegetation Cover Type by Location	Description
License Area	
Deschampsia Grassland	Vegetation is dominated by the bunchgrass <i>Deschampsia australis</i> , in dry-mesic to wet-mesic settings at subalpine elevations on gentle to moderate slopes. Sparse native shrubs such as <i>Styphelia</i> , <i>Vaccinium</i> , <i>Geranium</i> , etc. may be found between grass tussocks.
Native Shrubland (alien grasses)	Vegetation is dominated by a mixture of mostly native shrubs and alien grasses, typically along the transition between native-dominated shrublands at higher elevations and Alien Grassland below. Heterogeneous signatures are often complicated by steep and complex terrain.
Native Shrubland/ Sparse 'Ōhi'a (native shrubs)	Vegetation is dominated by shrubs, typically in dry to dry-mesic settings, often at high montane and subalpine elevations but occasionally in lowland dry and mesic settings. Typical dominants include pukiaawe (<i>Styphelia</i>), 'a'ali'i (<i>Dodonaea</i>), and 'ōhi'a (<i>Metrosideros</i>); subalpine examples are often strongly dominated by <i>Styphelia</i> ; lower elevation occurrences are more mixed.
Native Wet Cliff Vegetation	Vegetation is dominated by shrubs and ferns, on a steep aspect, from lowland to montane elevations, in wet settings. Typical species include <i>Metrosideros</i> , <i>Coprosma</i> , <i>Vaccinium</i> , <i>Machaerina</i> , and <i>Dicranopteris</i> .
Uluhe Shrubland	Vegetation is dominated by a shrubland (technically, a fernland) of uluhe (<i>Dicranopteris linearis</i>) and/or other native mat ferns (e.g., <i>Sticherus</i> , <i>Diplopterygium</i>), generally on moderate and steep mesic to wet slopes, from lowland to montane elevations, typically on windward island slopes. This vegetation type often has a varying presence of native shrubs and sparse native trees, which typically includes 'ōhi'a (<i>Metrosideros polymorpha</i>).
Closed Koa-'Ōhi'a Forest (native shrubs)	Vegetation is dominated by a closed canopy of koa (<i>Acacia koa</i>) and 'ōhi'a, (<i>Metrosideros polymorpha</i>) with varying understories dominated by hāpu'u (<i>Cibotium</i> sp.), native shrubs, strawberry guava (<i>Psidium cattleianum</i>), or uluhe (<i>Dicranopteris linearis</i>), generally on moderate mesic to wet slopes, from lowland to montane elevations.
Closed Koa-'Ōhi'a Forest (uluhe)	Vegetation is dominated by a closed canopy of koa (<i>Acacia koa</i>) and 'ōhi'a, with varying understories dominated by uluhe (<i>Dicranopteris linearis</i>), generally on moderate mesic to wet slopes, from lowland to montane elevations.
Closed 'Ōhi'a Forest (native shrubs)	Vegetation is dominated by a closed canopy of 'ōhi'a (<i>Metrosideros polymorpha</i>) and other native trees, with varying understories dominated by hāpu'u (<i>Cibotium</i> sp.), native shrubs or uluhe (<i>Dicranopteris linearis</i>), generally on moderate mesic to wet slopes from lowland to montane elevations.
Closed 'Ōhi'a Forest (uluhe)	Vegetation is dominated by a closed canopy of 'ōhi'a (<i>Metrosideros polymorpha</i>) and other native trees, with varying understories dominated by uluhe (<i>Dicranopteris linearis</i>), generally on moderate mesic to wet slopes, from lowland to montane elevations.
Open 'Ōhi'a Forest (native shrubs)	Vegetation is dominated by an open canopy of 'ōhi'a (<i>Metrosideros polymorpha</i>) and other native trees, with an understory dominated by hāpu'u tree ferns (<i>Cibotium</i> spp.), alien grasses, native shrubs, or uluhe (<i>Dicranopteris linearis</i>) and/or other native mat ferns, (e.g., <i>Sticherus</i> , <i>Diplopterygium</i>), typically at lowland-montane elevations, in mesic-wet zones.
Open 'Ōhi'a Forest (uluhe)	Vegetation is dominated by an open canopy of 'ōhi'a (<i>Metrosideros polymorpha</i>) and other native trees, with an understory dominated by uluhe (<i>Dicranopteris linearis</i>) and/or other native mat ferns, (e.g., <i>Sticherus</i> , <i>Diplopterygium</i>), typically at lowland-montane elevations, in mesic-wet zones.
Low Intensity Developed	Adopted with minor changes from the Coastal Change Analysis Program's Low Intensity Developed land cover class, thus defined: "Contains substantial amounts of constructed surface mixed with substantial amounts of vegetated surface. Small buildings (such as single family housing, farm outbuildings, and sheds), streets, roads, and cemeteries with associated grasses and trees typically fall into this subclass."
Alien Grassland	Vegetation consists of uncharacterized mixed alien grasslands, often at low elevations, often as part of complex vegetation mosaics of grass, shrubs, and trees. This class includes large areas dominated by fountain grass (<i>Pennisetum setaceum</i>), buffel grass (<i>Cenchrus ciliaris</i>), kikuyu grass (<i>Pennisetum clandestinum</i>), and other species. This class also includes the planted grass of parks and golf courses.

Vegetation Cover Type by Location	Description
Kikuyu Grass Grassland/Pasture	Vegetation consists of large areas dominated by kikuyu grass. This class also includes pastures.
Alien Forest	Vegetation consists of mixed, typically dense canopies of alien tree species, often plantation forest plantings, with dominants, including but not limited to <i>Eucalyptus</i> , <i>Casuarina</i> , <i>Falcataria</i> , <i>Araucaria</i> , <i>Fraxinus</i> , <i>Melaleuca</i> , <i>Psidium</i> , and <i>Grevillea</i> spp. Found at lowland and montane, wet-mesic to mesic settings, often at the lower elevation edge of forest reserves.
Uncharacterized Forest	Vegetation consists of an open-closed canopy forest, most often at low elevations, part of a complex mosaic of naturalized alien vegetation in a mosaic of forest, shrubland, and grassland. Small occurrences of native forest also may be found in this class.
Uncharacterized Open-Sparse Vegetation	Vegetation is dominated by open to sparse vegetation, occurring at all elevations, part of a complex mosaic of naturalized alien vegetation in a mosaic of forest, shrubland, and grassland. May also include very sparse native vegetation at higher elevations and pioneer native vegetation.
Uncharacterized Shrubland	Vegetation is dominated by mixed, typically closed shrub vegetation, occurring at a variety of elevations, part of a complex mosaic of naturalized alien vegetation in a mosaic of surrounding forest, shrubland, and grassland. May also include small occurrences of native shrubland.
Very Sparse Vegetation to Unvegetated	Largely unvegetated, typically open lava or cinder substrates occupying dry settings at subalpine and alpine elevations (Maui and Hawai'i Islands) but also occurring in lower dry settings, especially on very young lava flows in the earliest seral stages or weathered soil or rock substrates on older islands.
Service Area	
Deschampsia Grassland	See above.
Native Shrubland/Sparse 'Ōhi'a (native shrubs)	See above.
Closed 'Ōhi'a Forest (native shrubs)	See above.
Open 'Ōhi'a Forest (uluhe)	See above.
Water	Inland water bodies and coastal fishponds of at least 0.36 hectare in area. This class is primarily derived from the National Hydrography Dataset.
Agriculture	Vegetation is dominated by planted lands of variable physiognomy, with annual to multiyear stability. May include ordered rows of tree plantings (often dense) in agricultural-zoned lands, typically in lowland mesic and wet settings. May include a wide variety of dominants, including macadamia, coconut, banana, guava, papaya, sugarcane, pineapple, coffee, vegetable crops, and fallow fields.
Alien Shrubs and Grasses	Highly variable mixed shrubland/grassland is dominated locally by one or more species, including <i>Lantana camara</i> , koa haole (<i>Leucaena leucocephala</i>), Christmasberry (<i>Schinus terebinthifolius</i>), klu (<i>Acacia farnesiana</i>), fountain grass (<i>Pennisetum setaceum</i>), buffel grass (<i>Cenchrus ciliaris</i>), kikuyu grass (<i>Pennisetum clandestinum</i>), and other species. Often grades into agricultural plantings or mixed alien grasslands.
High Intensity Developed	Adopted with minor changes from the Coastal Change Analysis Program's High Intensity Developed land cover class, thus defined: "Contains little or no vegetation. This subclass includes heavily built-up urban centers as well as large constructed surfaces in suburban and rural areas. Large buildings (such as multiple family housing, hangars, and large barns), interstate highways, and runways typically fall into this subclass."
Low Intensity Developed	See above.
Alien Grassland	See above.
Alien Shrubland	Vegetation consists of highly variable mixed shrubland dominated locally by one or more species, including <i>Lantana camara</i> , koa haole, Christmasberry, klu, and others. Often grades into agricultural plantings or mixed alien grasslands.
Alien Forest	See above.

Vegetation Cover Type by Location	Description
Closed Kiawe-Koa Haole Forest and Shrubland	Vegetation is dominated by a closed canopy of the alien shrubs/trees kiawe (<i>Prosopis pallida</i>) and koa haole (<i>Leucaena leucocephala</i>), typically found in dry coastal settings, with dense stands adjacent to fresh groundwater sources near sea level.
Open Kiawe Forest and Shrubland (alien grasses)	Vegetation is dominated by an open canopy of the alien shrub/tree kiawe (<i>Prosopis pallida</i>), with an understory of alien grasses (most often <i>Cenchrus ciliaris</i>), and grading into Koa Haole Shrubland and/or Fountain Grass/Buffel Grass Grassland. Typically found in dry coastal settings, with dense stands adjacent to fresh groundwater sources near sea level.
Uncharacterized Forest	See above.
Uncharacterized Open-Sparse Vegetation	See above.
Uncharacterized Shrubland	See above.
Very Sparse Vegetation to Unvegetated	See above.

Source: Gon et al. 2006.

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APPENDIX C

Photographs of Vegetation Types for the Proposed East Maui Water Lease



Figure C-1. Photograph of the Alien Forest vegetation type, which occurred frequently throughout ground surveys of the License Area. Plant species in this photograph include paperbark (*Melaleuca quinquenervia*), eucalyptus (*Eucalyptus* spp.), shoebutton ardisia (*Ardisia elliptica*), strawberry guava (*Psidium cattleianum*), Job's tears (*Coix lachryma-jobi*), and Koster's curse (*Clidemia hirta*).



Figure C-2. Photograph of the Open 'Ōhi'a Forest vegetation type with the Uluhe Shrubland vegetation type in the foreground, taken during ground surveys of the License Area. Plant species in this photograph include ohia (*Metrosideros polymorpha*) and uluhe (*Dicranopteris linearis*).



Figure C-3. Photograph of the Native Wet Cliff vegetation type, taken during ground surveys of the License Area. Plant species in this photograph include *Cyrtandra* cf. *grayi*, *Cyclosorus parasiticus*, and a *Machaerina* species.



Figure C-4. Photograph of the Uncharacterized Open-Sparse vegetation type, taken during ground surveys of Pi'ina'au Road in the License Area. Plant species in this photograph include Job's tears (*Coix lachryma-jobi*), Guinea grass (*Urochloa maxima*), tick trefoil (*Desmodium triflorum*), sensitive plant (*Mimosa pudica* var. *unijuga*), elephant's-foot (*Elephantopus mollis*), and shoebutton ardisia (*Ardisia elliptica*).



Figure C-5. Photograph of the Agriculture vegetation type, taken during ground surveys of the Service Area. Plant species in the background include sugarcane (*Saccharum officinarum*) and Guinea grass (*Urochloa maxima*). Some weedy herbaceous plants were seen nearby, including little bell (*Ipomoea triloba*) and cheeseweed (*Malva parviflora*).



Figure C-6. Photograph of the vegetation found along Paia Mill Road, in the Service Area, which includes the Alien Grassland and Alien Forest vegetation types. Alien Grassland species in the foreground include swollen finger grass (*Chloris barbata*), Guinea grass (*Urochloa maxima*), and pitted beardgrass (*Bothriochloa pertusa*). Tree and shrub species in the background include Taiwanese cheesewood (*Pittosporum pentandrum*), Koa haole (*Leucaena leucocephala*), Christmas berry (*Schinus terebinthifolius*), and kiawe (*Prosopis pallida*).



Figure C-7. Photograph of one of the holding ponds in the Service Area, which provide habitat for several non-native wetland species and non-native shrubs and trees. Plants in the foreground include California grass (*Urochloa mutica*), Java plum (*Syzygium cumini*), and Koa haole (*Leucaena leucocephala*). Plants in the background include primrose-willow (*Ludwigia octovalvis*), sourbush (*Pluchea carolinensis*), Taiwanese cheesewood (*Pittosporum pentandrum*), and Christmas berry (*Schinus terebinthifolius*).



Figure C-8. Photograph of the typical vegetation around High Intensity Developed areas in the Service Area. Species in these areas include cultivated plants and tolerated weed species. Shown in the foreground are snowbush (*Breynia disticha*), mock orange (*Murraya paniculata*), panax (*Polyscias guilfoylei*), St. Augustine grass (*Stenotaphrum secundatum*), and morning glory (*Ipomoea obscura*).

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APPENDIX D

Voucher Specimen Descriptions

Table D-1. Voucher Specimen Descriptions

Species Name	Location	Elevation	Collection Year
<i>Clermontia samuelii</i>	Kawaipapa Stream, along stream on wet cliff walls, above Nahiku-Hana area	856 m	2013
<i>Clermontia samuelii</i> ssp. <i>hanaensis</i>	East Maui, Hana District, Nahiku AHU, Tr 9(32), north slope of Haleakala, east of Kuhiwa Stream and Valley	3,210 feet	1980
<i>Clermontia samuelii</i> ssp. <i>hanaensis</i>	Hana District, Kawaipapa Stream, above Nahiku-Hana area	936 m	2013
<i>Cyanea copelandii</i> ssp. <i>haleakalaensis</i>	Ko'olau Gap, Ke'anae Valley, east Piinaau drainages	884 m	2007
<i>Cyanea duvalliorum</i>	East Maui, Ke'anae Valley	–	1911
<i>Cyanea duvalliorum</i>	Trail east of Ke'anae and up the ridge between West and East Wailuaiki Stream	–	1920
<i>Cyanea hamatiflora</i> ssp. <i>hamatiflora</i>	Ke'anae Valley	–	1927
<i>Cyanea hamatiflora</i> ssp. <i>hamatiflora</i>	East Maui, Hana District, Ko'olau Forest Reserve, in gulch along East Wailuaiki Stream	975 m	1980
<i>Cyanea horrida</i>	Makawao District, upper western tributary of Honomanu Stream, northeast of Pu'u Luau, Waikamoi Preserve	6,000 feet	2008
<i>Cyanea horrida</i>	Waikamoi Preserve, Honomanu Gulch	6,800 feet	1989
<i>Cyanea horrida</i>	Makawao District, Waikamoi Preserve, below Hosmer Grove	1,785 m	2013
<i>Cyanea horrida</i>	Northeast Haleakala, near Ke'anae Valley	–	1954
<i>Cyanea horrida</i>	East Maui, Nahiku	–	1909
<i>Cyanea kunthiana</i>	East Maui, northeast of Ke'anae Valley	1,524 m	1954
<i>Cyanea kunthiana</i>	East Maui, Hana District, Nahiku watershed, east of Kuhiwa Stream and Valley, Ko'olau Forest Reserve	1,777 m	1980
<i>Cyanea kunthiana</i>	East Maui, Waikamoi, Hāmākua, East Maui, along the trail to Honomanu Gulch	914–1,219 m	1910
<i>Cyanea kunthiana</i>	East Maui, Waikamoi, Slopes of Haleakala, wet forest between Waikamoi and Honomanu Gulch, along Kula Pipeline trail	4,200 feet	1910
<i>Cyanea kunthiana</i>	East Maui, Hana District, Nahiku watershed, north slope of Haleakala, east of Kuhiwa Stream and Valley, Koolau Forest Reserve	1,746 m	1980
<i>Cyanea maritae</i>	East Maui, Ke'anae	–	1911
<i>Cyanea mcelandowneyi</i>	Makawao District, Honomanu Gulch, on spur trail from west rim into stream	3,680 feet	2013
<i>Cyanea mcelandowneyi</i>	Makawao District, Honomanu Gulch	3,800 feet	2013
<i>Cyanea mcelandowneyi</i>	Makawao District, Nahiku watershed, north slope of Haleakala, east of Kuhiwa Stream and Valley	978 m	1980
<i>Geranium multiflorum</i>	East Maui, upper Honomanu Gulch	2,042 m	1984
<i>Ischaemum byrone</i>	Pauwalu Point, near Ke'anae	5 m	1933
<i>Ischaemum byrone</i>	Pauwalu Point, Ke'anae	24 m	1978
<i>Ischaemum byrone</i>	Hana District; Ke'anae, Pauwalu Point, sea cliffs	53 m	2012
<i>Melicope balloui</i>	East Maui, Makawao District, Waikamoi Preserve, western Honomanu drainage basin	6,050 feet	2011

Species Name	Location	Elevation	Collection Year
<i>Melicope balloui</i>	East Maui, Makawao District, Waikamoi Preserve, western Honomanu drainage basin, east-northeast of Pu'u Luau	5,900 feet	2012
<i>Melicope balloui</i>	East Maui, Makawao District, Waikamoi Preserve, Honomanu drainage basin	6,000 feet	2012
<i>Melicope ovalis</i>	East Maui, Hana District, western Ke'anae Valley, Pi'ina'au Stream	2,225 feet	2014
<i>Melicope ovalis</i>	East Maui, Hana District, Ke'anae Valley/Ko'olau Gap	3,720 feet	2011
<i>Wikstroemia villosa</i>	East Maui, Makawao District, eastern Honomanu drainage basin	4,700 feet	2012
<i>Wikstroemia villosa</i>	Nahiku	–	1909

Source: Bernice Pauahi Bishop Museum *Herbarium Pacificum*. 2015.

APPENDIX E

**Endangered and Threatened Fauna Species
(Federal and State) with the Potential to Occur in the
License Area and Service Area**

Table E-1. Endangered and Threatened Fauna Species (Federal and State) with the Potential to Occur in the License Area and Service Area

Common Name (Scientific Name)	Status*	Range or Habitat Requirements†	Potential for Occurrence in License and Service Areas
Birds			
Crested honeycreeper (<i>Palmeria dolei</i>)	Endangered	Found in East Maui in forest habitat at least 4,200 feet in elevation. It feeds on nectar from the 'ōhi'a flower and other native plants and will also eat insects and fruits.	Known to occur in the license area; the license area is within their known range.
'i'iwi (<i>Vestiaria coccinea</i>)	Threatened	Found in closed forest habitat composed of tall 'ōhi'a trees or 'ōhi'a and koa tree mixed forests. It feeds on nectar from 'ōhi'a, mamane, and lobelioids (USFWS 2017a).	Known to occur in the license area; one was aurally detected while conducting pedestrian surveys below an elevation of 1,500 feet.
Maui parrotbill (<i>Pseudonestor xanthophrys</i>)	Endangered	Found in forest habitat from 4,300 to 6,800 feet in elevation, in subcanopy trees and understory plants. Parrotbills feed on insect larvae by splitting dry branches.	Known to occur in the license area; the license area is within its known range.
Hawaiian coot (<i>Fulca alai</i>)	Endangered	Found in wetland habitat. This species is associated with emergent marshes in lowland valleys, reservoirs, and occasionally in high-elevation plunge pools. Nests are built on floating vegetation.	Known to occur in the service area; Hawaiian coot were observed in the holding ponds during the survey.
Hawaiian stilt (<i>Himantopus mexicanus knudseni</i>)	Endangered	Prefers a variety of wetland habitats but is limited by water depth and vegetation cover. This species loafs in open mudflats, sparsely vegetated pickleweed mats, and open pastures. Specific water depths of 5 inches are required for optimal foraging. Nest sites are frequently separate from feeding sites, and stilts move between these areas daily. Nesting sites are adjacent to or on low islands within bodies of fresh, brackish, or salt water.	Known to occur in the service area; Hawaiian stilt were observed in the holding ponds and on access roads during the survey.
Hawaiian duck (<i>Anas wyvilliana</i>)	Endangered	Found in lowland, river valley, and mountain stream wetland habitats. This species nests on the ground near water (USFWS 2011).	May occur; foraging habitat occurs in the license area and service area and it could nest in vegetation adjacent to the mountain streams and holding ponds.
Hawaiian goose or nēnē (<i>Branta sandvicensis</i>)	Endangered	Frequents shrubland, grassland, wetland, rocky, and developed/agricultural habitats. It does not require standing or flowing water for successful breeding but will use it when available. Nest sites include various habitat types ranging from beach strand, shrubland, and grassland to lava rock, in elevations ranging from coastal lowlands to alpine areas (Banko 1988; Banko et al. 1999). This species' current distribution has been highly influenced by captive-bred releases into the wild.	Known to occur. Suitable foraging habitat occurs in the grassland and shrubland habitats of the license area and service area.
Hawaiian petrel (<i>Pterodroma sandvichensis</i>)	Endangered	Breeding season is from March to October, during which time this species nests in some of the main Hawaiian Islands, notably on Maui, Lāna'i, and Kaua'i. This species nests in burrows, primarily in remote locations in forest, shrubland, grassland, rocky, and cliff habitats, near large rock outcrops, under cinder cones, under old lichen-covered lava, or in soil beneath dense vegetation. This species was once abundant on all main Hawaiian islands except Ni'ihau. Currently, the largest known breeding colonies are found at Haleakala Crater on Maui and on the summit of Lāna'i. Other colonies are on Kaua'i, the island of Hawai'i, and possibly Molokai.	May occur in the license area and fly over the service area. Hawaiian petrels may nest in the grassland, shrubland, and cliff habitats in the license area and may fly over the service area at night while transiting between nest sites and the ocean. It is not likely to land or use habitat in the service area because nesting habitat does not occur there.

Common Name (Scientific Name)	Status*	Range or Habitat Requirements†	Potential for Occurrence in License and Service Areas
Newell's shearwater (<i>Puffinus auricularis newelli</i>)	Threatened	During its 9-month breeding season (April through November), this species nests in forest, shrubland, grassland, rocky, and cliff habitats under ferns on forested mountain slopes and needs an open downhill flight path through which it can become airborne. Nest burrows are used year after year, usually by the same pair of birds. This species was once abundant on all of the main Hawaiian Islands and has been documented breeding on Maui in small numbers (Ainley et al. 1997).	May occur in the license area and fly over the service area. Newell's shearwater may nest in the grassland, shrubland, and cliff habitats in the license area and may fly over the service area at night while transiting between nest sites and the ocean. It is not likely to land or use habitat in the service area because nesting habitat does not occur there.
Band-rumped storm petrel (<i>Oceanodroma castro</i>)	Proposed endangered	This species is found in several areas of the subtropical Pacific and Atlantic Oceans. In Hawaii, this species is known to nest on Kauai, Lehua Islet, and the Island of Hawaii; it likely nests in remote cliff habitat locations. Only three inactive nests have ever been found in the Hawaiian Islands; all were located in small caves or crevices. Adults of this species visit the nest site after dark. Vocalizations have been heard within Haleakala Crater (USFWS 2016). When not at nest locations, it forages on the open ocean.	May occur in the license area and fly over the service area. Band-rumped storm petrel may nest in the grassland, shrubland, and cliff habitats in the license area and may fly over the service area at night while transiting between nest sites and the ocean. It is not likely to land or use habitat in the service area because nesting habitat does not occur there.
Mammals			
Hawaiian hoary bat (<i>Lasiurus cinereus semotus</i>)	Endangered	This species is found primarily from sea level to 7,500 feet, although it has also been observed above 13,000 feet. The Hawaiian hoary bat can be found in forest, shrubland, grassland, wetland, rocky, cliff, and developed/agricultural habitats. Most of the available documentation suggests that this elusive bat roosts among trees in forested areas. It has been observed on the islands of Hawaii, Maui, Moloka'i, Oahu, and Kauai.	Likely to occur in the license area and service area. Bat roosting could occur in the Forest and Agriculture habitats and foraging could occur in Forest, Grassland, Shrubland, Wetland, Agriculture, Water, and Cliff habitats.
Reptiles			
Green sea turtle (<i>Chelonia mydas</i>)	Threatened	The green sea turtle is found worldwide in warm seas. It occupies three habitat types: open beaches, open sea, and feeding grounds in shallow, protected waters. Nesting occurs throughout the Hawaiian archipelago. This species has been documented transiting some Hawaii rivers up to 2 miles (3 kilometers) inland.	Unlikely to occur in the license and service areas. The license area contains streams that connect to the ocean. The green sea turtle is not able to traverse the steep waterfalls in the license area and the wetland habitat in the service area does not connect to the ocean.
Hawksbill sea turtle (<i>Eretmochelys imbricata</i>)	Endangered	The hawksbill sea turtle is found in warm tropical waters worldwide. It is a shy tropical reef-dwelling species that feeds on jellyfish, sea urchins, and sea sponges. It may also eat algae that grows on the reef. In Hawaii, nesting occurs on the Islands of Hawaii, Maui, Moloka'i, and Oahu.	Unlikely to occur in the license and service Areas. The hawksbill sea turtle is not known to travel up streams in Hawaii.

Common Name (Scientific Name)	Status*	Range or Habitat Requirements†	Potential for Occurrence in License and Service Areas
Invertebrates			
Blackburn's sphinx moth (<i>Manduca blackburni</i>)	Endangered	Occurs in topographically diverse landscapes from sea level to 5,000 feet that contain low to moderate levels of non-native vegetation. The Blackburn's sphinx moth uses shrubland, grassland, rocky, and developed/agricultural habitats. Most historical records were from coastal or lowland dry forest habitats in areas receiving less than 50 inches annual rainfall. The non-native tree tobacco is a typical host plant for the species.	May occur in the service area. Tree tobacco was documented throughout the service area.
Flying earwig Hawaiian damselfly (<i>Megalagrion nesiotes</i>)	Endangered	The biology of the flying earwig damselfly is not understood, and it is not known if it prefers standing or flowing water. The only confirmed population occurs along a single stream in East Maui that is adjacent to cliff habitat with uluhe (USFWS 2017b).	Known to occur in the license area. The flying earwig Hawaiian damselfly occurs within and adjacent to wetland and cliff habitat.
Orangeblack Hawaiian damselfly (<i>Megalagrion xanthomelas</i>)	Endangered	Occurs within anchialine pool, coastal, lowland dry, and lowland mesic ecosystems in wetland habitat. On Maui, this species is known to occur at an undisclosed location in the West Maui mountains (USFWS 2016) and near anchialine pools in East Maui (Polhemus et al. 1999).	May occur in the license area. The orangeblack Hawaiian damselfly is known to occur at an undisclosed location in East Maui near anchialine pools.
Pacific Hawaiian damselfly (<i>Megalagrion pacificum</i>)	Endangered	Occurs almost exclusively in wetland habitat that consists of seepage-fed pools along overflow channels in the terminal reaches of perennial streams in areas surrounded by dense vegetation (USFWS 2017b).	Known to occur in the license area. The Pacific Hawaiian damselfly occurs in and adjacent to wetland habitat.
Yellow-faced bee (<i>Hyaleus anthracinus</i>)	Endangered	Known to occur at two locations (Kanaio and Manawainui [Magnacca 2005] on Maui in the coastal and lowland dry ecosystems.	Unlikely to occur; not known to occur in the license area and service area.
Yellow-faced bee (<i>H. assimulans</i>)	Endangered	Currently known to occur at only two locations on Maui in coastal and lowland dry forest habitat (USFWS 2016).	Unlikely to occur; not known to occur in the license area and service area.
Yellow-faced bee (<i>H. longiceps</i>)	Endangered	Currently restricted to small patches of coastal and lowland dry habitat on Maui (USFWS 2016).	Unlikely to occur; not known to occur in the license area and service area.

* Federal (USFWS) status definitions: Endangered = Any species considered by the USFWS as being in danger of extinction throughout all or a significant portion of its range. The ESA specifically prohibits the take of a species listed as endangered. Take is defined by the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to engage in any such conduct. Proposed = Any species of fish, wildlife, or plant that is proposed in the *Federal Register* to be listed under Section 4 of the ESA. Threatened = Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The ESA specifically prohibits the take of a species listed as threatened.

† Unless otherwise noted, data are from USFWS (2014).